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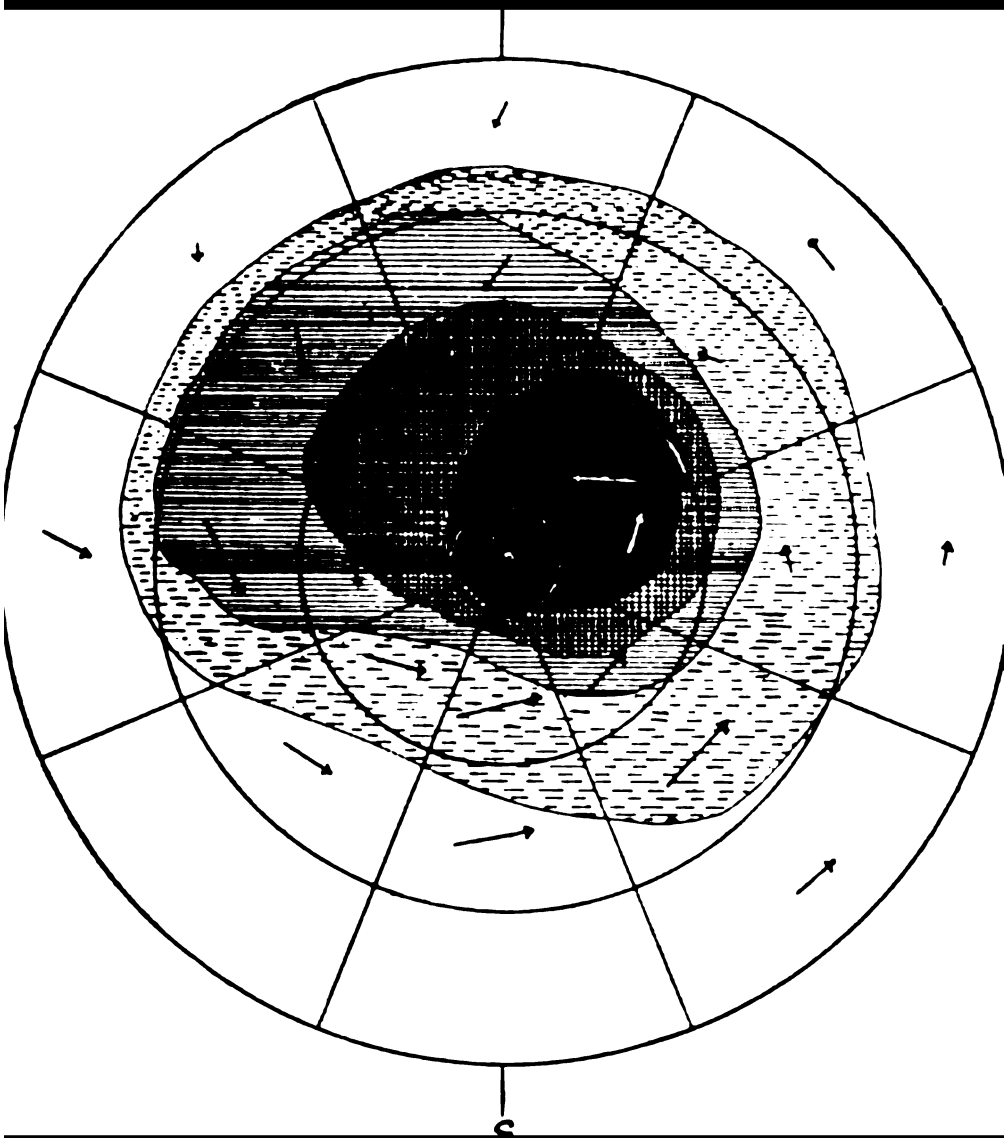
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Symons's Meteorological Magazine.

No. 481.

FEBRUARY, 1906.

VOL. XLI.

OUR FORTY-FIRST VOLUME AND THE RAINFALL TABLES.

WITH this number our forty-first volume commences, and the occasion seems to be appropriate for a few words to our readers on the objects for which this Magazine was founded and the means by which we endeavour to carry these aims into effect. Originally a two-page "Rain Circular," intended to keep the keener rainfall observers in touch with each other's work from month to month, it became an 8-page magazine in 1866, including one page of rainfall tables and four pages of remarks by observers on the weather of the month. Correspondence dealing with matters of immediate interest to meteorological observers soon came to occupy an important place, and the review of meteorological books, both English and foreign, was made a leading feature. The proceedings of meteorological societies in this country were always recorded punctually. Extreme conciseness was necessary on account of the modest size of the little Magazine, and as the monthly numbers grew to two and a half times their original size (though the price stood still at the original figure), the additional space was devoted to more numerous reviews, more frequent illustrations, and to occasional articles of a more abstract kind bearing on meteorological theories. More subjects were dealt with, but if anything the literary matter was more concentrated than before.

We are endeavouring to maintain this Magazine as a repository of recent meteorological news, as a mirror of meteorological thought, so far as meteorological thinkers care to allow their reflections fall upon it, and as an independent medium for the expression of opinion. It is true that to some extent the Magazine is supplementary to the annual volumes of "British Rainfall," and that its relation with rainfall observers is rather more intimate than with students of meteorology in general, but we should not like this fact to affect the conduct of the paper in any way.

Our attitude is one of friendliness to every person and institution engaged in the serious study of the atmosphere, and our ambition is to be helpful to all and to interfere with none. We see with

pleasure that during the last few years meteorology has entered upon a period of rapid advance, in which the observer has a smaller share than the investigator, but we see also on every hand how the work of the investigator has been hampered and harassed by the want of the solid basis of patiently accumulated fact which only a succession of conscientious and persevering observers can bring together. Both types of activity meet in our pages, and sometimes one, sometimes the other, preponderates, but we do not regard them as antagonistic and would view it as a calamity if either were to be discouraged. It is becoming more than ever necessary that while work is encouraged in every department, and the natural aptitudes of those who are enthusiastic taken advantage of to the full, the waste of time and money resulting from the overlapping of agencies working with the same ends in view should be checked and co-operation between them secured. There are difficulties in the way of such a result, but they do not seem to us to be insuperable.

We have referred before to the wonderful instinct, or rather genius, with which the founder and first editor, Mr. G. J. Symons, hit upon methods of presenting meteorological data which required scarcely any modification as the years went on, and it is only after long thought and much delay that we have allowed ourselves to make the slightest change. New readers and old friends often favour us with advice which we are always glad to receive and consider, and though the advice of an individual cannot always be accepted, we believe that the change in the Tables of Temperature and Rainfall which we introduce this month gives effect to a great number of the desiderata which have been put before us during the last five years. New observers constantly want to know the precise position of the stations the records of which are quoted, and in the new combined Table on pp. 16-17 we give not only the name and county but also the latitude and longitude to the nearest minute. A minute of latitude is a trifle more than a mile, a minute of longitude in these latitudes rather more than half a mile, so that on a map of the British Isles on the scale of 20 miles to an inch the position of each station is within an area not much larger than a pin head at the intersection of the parallel and meridian which are designated. The height above sea-level is given also in feet, usually correctly, and probably in no case more than 20 feet in error. The temperature data are given exactly as before, but we are unable to say that the figures are really comparable, because all the thermometers are not exposed alike nor are all the instruments verified. It is incomprehensible to us how observers will sometimes lavish hours and days of their valuable time in reading scales, entering, adding, averaging and pondering over figures derived from thermometers which only cost perhaps half-a-crown, and were not worth that; yet we know that many people do so. As we do not know in every case that trustworthy thermometers are employed,

we lay less stress upon the first page of this table than on the second.

The second half of the Table, on p. 17, combines the former monthly rainfall table and the aggregate table, which for the last few years has wandered somewhat uneasily through the text. It contains additional information as well. To begin with, we give the average rainfall for the month in question at most stations, calculated in each case to the period of thirty years, 1870—99. A fifty-years' average would be better for monthly amounts, but the data are not available. In the next column the actual rainfall is expressed as a percentage of the average. In other words, the average rainfall for each station is represented as 100 and the actual rainfall is given by a figure bearing the same ratio to 100 as the number of inches measured bears to the average amount. Then follows the actual rainfall for the month as measured up to 9 a.m. on the 1st of the month following, and the difference between the actual and the average rainfall, the positive sign (+) indicating that the rainfall of the month is above the average, the negative sign (—) that it is below the average. The fall on the wettest day in the month, the date of that day, and the number of rain days—i.e., days on which at least .01 in. of rain was recorded—complete the statistics for the month.

The next four columns, blank on this occasion as they would merely be a repetition of the foregoing, will give the total rainfall from January 1st to the end of the month dealt with. Then in bold type comes the mean annual rainfall calculated to the average of 30 years, and the line is closed by the repetition in a somewhat abbreviated form of the name of the station, for the bookbinder is not always successful in folding the sheets so that the two pages shown at an opening correspond line for line.

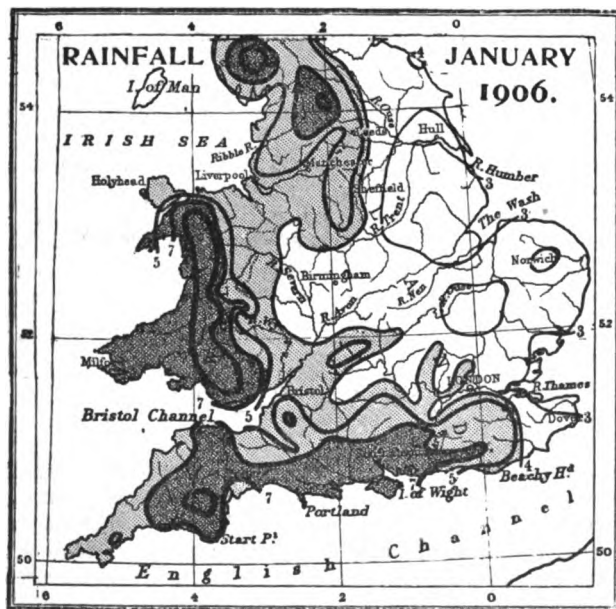
The new Table involves a greater expenditure of time than the old form, and we urge our readers whose records appear in it to send in their returns as early as possible, and at the latest by the 8th of the month. The compilers do not grudge their work, believing that the Table as now presented is both more interesting and more useful than it was before.

THE RAINFALL OF THE SOUTH OF ENGLAND IN JANUARY, 1906.

THE remarkable dryness of December, 1905, has been followed by a wet month in almost all parts of the country, and more particularly in the south of England. In the east of Scotland alone the rainfall was below the average; over the greater part of Scotland and Ireland the excess was less than 50 per cent., and we have heard of no case in either country in which the fall reached twice the average.

The stations cited in the table on p. 17 are sufficiently uniformly distributed to allow us to take the average of a large group of them as the general rainfall of the area they represent, and by doing so we find that in January, 1906, the general rainfall of Scotland showed an excess of 23 per cent., that of Ireland of 48 per cent., and that of England and Wales of 79 per cent. None of these figures is in any way unusual, for the rainfall of a couple of very wet days may in most places equal the average of a month. A large part of the country is often subjected to more than double the average monthly rainfall, and in January, 1906, this occurred along a pretty wide belt of country from Devon to Norfolk, passing through London, which was relatively the wettest part of the country. The actual figures of rainfall recorded in this belt were somewhat remarkable, and we reproduce a rainfall map of the south of England showing the way in which a rainfall exceeding 5·00 in. prevailed over that part of the country, and that a rainfall of 7·00 in. and upwards spread eastward into the middle of Sussex, and in several a fall exceeding 8·00 inches was recorded.

We are indebted to many correspondents for kindly sending special notes of the remarkably heavy falls, chiefly in eastern Hampshire and western Sussex, and though we only publish a selection, we are equally grateful for all the letters.



The rainfall here in January was 4·46 in., falling on 22 days. It is the greatest in any January since 1877, when I registered 4·93 in. on the same spot, but not by the same gauge.

The January rainfall has already raised the plane of saturation in the chalk in this neighbourhood, on or near the water-parting between the valleys of the Gade and Colne, a little more than two feet.

Westwood, Watford, Feb. 9th, 1906.

JOHN HOPKINSON.

Dec. 30	.....	in. '02
" 31	.....	'18
Jan. 1	.....	'68
" 2	.....	'80
" 3	.....	'31
" 4	.....	'73
" 5	.....	'61
" 6	.....	'29
" 7	.....	'32
" 8	.....	'05
" 9	.....	'12
" 10	.....	'01
" 11	.....	'28
" 12	.....	'30
" 13	.....	'21
" 14	.....	'03
" 15	.....	'28
" 16	.....	'42
" 17	.....	'20
" 18	.....	'19
" 19	.....	'01
" 20	.....	'02

I find that in several places around here there has not been a record of continuous rainfall quite so long or so unbroken as I have noted here. I think that I may therefore send you my experience. I do not remember ever before to have noted 22 consecutive days with rain.

W. C. PLENDERLEATH.

Blyth, Dawlish, S. Devon,

Feb. 3rd, 1906.

I send you my notes on rainfall in January. They are somewhat remarkable, constituting a "record" for January during 70 years:—

Total rainfall in January, 1906 9·77 in.

Average ,, ,, ,, 1834 to 1905... 3·90 ,,

Previously wet Januaries:—1872 ... 7·42 in. | 1894 ... 6·84 in.
1877 ... 8·28 ,, | 1904 ... 6·82 ,,

Chilgrove, Chichester, 13th Feb., 1906.

JOHN W. WOODS.

Rain fell here on twenty-three days in January, the total amount being 7·45 in., and the greatest fall in twenty-four hours 1·22 in. on the 16th. The wettest period was from 1st to 18th, during which there was only one day without rain; total for eighteen days 6·72 in. Winds S.E. round to W. The ten-years' mean for January is 2·96 in. The wettest January previously recorded at Hazelhurst (the record commenced in 1888) was 6·05 in. in 1904; of this amount 3·75 in. fell in the seven days 25th to 31st. The wet period continued until February 17th; during this part of February 4·27 in. fell—the total for twenty-four consecutive days on that occasion being 8·02 in. Prevailing winds S.W.

T. P. NEWMAN.

Hazelhurst, Haslemere.

		in.	
Jan. 1	.....	·25	
" 2	.....	2·50	
" 3	.....	1·00	
" 4	.....	·82	
" 5	.....	·48	
" 7	.....	·70	
" 8	.....	·05	
" 11	.....	·50	
" 12	.....	·57	
" 13	.....	·07	
" 15	.....	·12	
" 16	.....	·65	
" 17	.....	·14	
" 18	.....	·18	
		8·03	

You may possibly have been overwhelmed with letters *re* the phenomenal rainfall of the first 17 days of January, 1906; but as, at present, I have not heard of any in this neighbourhood, except at Compton (Rev. H. M. Langdale), I write to tell you of my record at Forest Side Vicarage, in West Sussex, close to the border of Hampshire.

From January 1st to 18th my rain gauge has recorded (by daily observations at 9 a.m.) no less than 8·03 in. The *average* January fall for the past 17 years, 1889–1905, is 2·51 in. As you will see, I measured close on that in one day! The wells, which had been very low in 1905, are now rising fast.

MARY B. PARSONS.

19th January, 1906.

P.S.—To complete the record taken here of the rainfall in January, I may add that the total amount for the month is 8·90 in.—M.B.P.

Forest Side Vicarage, Emsworth, Hants, 2nd Feb., 1906.

THE THUNDERSTORM OF FEBRUARY 8th, 1906.

A SEVERE thunderstorm of a somewhat exceptional kind swept over a large part of England on February 8th, causing considerable damage and no little alarm by the sudden outburst of vivid lightning loud thunder and violent hail, accompanied by fierce squalls often more destructive than the lightning. Winter thunderstorms, though common enough in the north-west of Scotland, where thunder is comparatively rare in summer, are so rare in the south-east of England as to arrest public attention, and we have consequently received many letters on the subject, a few of which we are able to reproduce. On this occasion the storm has more interest than always attaches to a stray phenomenon appearing out of due season, and we print first a letter from the Meteorological Office, asking for the records of self-recording instruments during the storm. Unfortunately, we are unable to show a barograph record, for the Redier barograph, with whose virtues and defects our readers must now be fairly familiar, had been taken to pieces eight days before the storm, and the four clocks which enter into its construction had been sent for a much-needed cleaning with a "faithful promise" of return within the week. The cheerful optimism of the skilled workman in his time-estimates is well known, and although we are sure that the barograph will return to its work like a giant refreshed—some time in the future—this particular storm has

meanwhile crept past Camden Square unrecorded barometrically between 2.50 and 3.5 p.m. We hope that some of our readers more fortunately circumstanced will be able to assist the Meteorological Office by sending traces of their barographs and other recording instruments.

We quote only a few of the letters we have received. The newspapers teem with instances of houses struck by lightning or severely damaged by wind, especially in East Anglia. It is interesting to note that the storm was felt in Norwich before 2 p.m., in Watford about 2.30, in London about 2.50, and at Tottingworth Park at 4 p.m. Slender data to found an estimate of rate of travel upon, but the figures suggest a rate of travel twice as fast north of London as south of it.

On the afternoon of Thursday, February 8th, a violent hail squall with much thunder and lightning occurred in the Midlands and the south-east of England, and in London it was accompanied by very striking changes of temperature and pressure.

The Director is of opinion that a detailed examination of the phenomenon in its connexion with the meteorological situation over the country as a whole, would yield interesting results, and he has instructed me to ask whether you would have the goodness to lend him for a short period the traces of your self-recording instruments for this day, or copies of them, and also furnish him with a brief account of any striking meteorological occurrence which may have come under your notice during the day in question. The value of such notes would be greatly increased by stating as accurately as possible the times at which the events took place. Any remarks which would aid in the correct evaluation of the time scale of the automatic records would also be most useful.

R. G. K. LEMPFERT.

*Meteorological Office, 63, Victoria Street, London, S. W.,
10th February, 1906.*

This morning was mild with a spring-like wind from the west. About 1 o'clock I noticed the wind was rising, the sun shining brightly at the time. At 1.30 there was a dark cloud in the west, and a few drops of rain fell and distant thunder was heard. At 1.40 we had a heavy clap of thunder with hail. After about two minutes the hail ceased and snow began to fall thick and fast. At 1.45 there was a strong flash of lightning closely followed by a crashing peal of thunder which seemed to shake the buildings. Another clap of thunder was heard about five minutes afterwards, and then ceased. Snow fell till 2.10 and then the weather cleared up, and at 3.30 the sky was clear and cloudless. Temperature in the shade had been as high as 45°·0 in the morning, but at 2.30 p.m. had gone down to 35°·0. At 9 a.m. the barometer registered 29·883 in., at 1 o'clock it

had gone down to 29.705 in. ; it did not fall during the storm, and up to the time of writing (4.45) shows no change either way. We had a heavy fall of snow for a few minutes about 4 o'clock. The sky is now clear and looks like being a sharp frost. Wind calm and still westward. Min. temperatures this week—Sunday, 31°0; Monday, 27°0; Tuesday, 21°0; Wednesday, 23°0; this morning, 30°0. The temperature is now 32°0. The oldest inhabitant does not remember such a heavy thunderstorm in the winter here.

WILLIAM HALL.

Swerford, Oxford, 8th February, 1906.

We had a thunderstorm here with big hail last Saturday night. Thunderstorms in February are very rare here, but *two* in that month are almost unknown. This afternoon from 1.50 to 2.20 we had a thunderstorm which might have been expected in June or July after an outburst of great heat, but which was most extraordinary at this season. The lightning flashes were frequent and brilliant, and the thunder peals followed almost instantaneously. Much hail accompanied the lightning, followed by heavy snow whitening the ground. There were only two storms (in June) all last summer of equal violence, and I have never known the like in February before.

ARTHUR W. PRESTON.

Christchurch Lodge, Eaton, Norwich, 8th February, 1906.

I see by the papers this morning that the storm was a general and not a local one—all the more unusual at this season. For the purpose of comparison I give you the *time* of the storm here. 1.35 p.m., first thunder; 1.55, storm broke in full fury; 2.10, storm passing; 2.20, last thunder.

A. W. P.

9th February, 1906.

A severe, short and remarkably sudden thunderstorm occurred here yesterday afternoon. A few distant peals of thunder were heard from about 2.25, and at 2.28 came a vivid flash of lightning with almost instantaneous thunder, followed by sleet, hail and snow. The storm was over in seven minutes, but the snow continued for some time, leaving the ground white until the following day and yielding .16 in. of rain.

A man in Watford, with a horse and cart, seeing the storm coming, threw a sack over his shoulders and was about to adjust a nose-bag on his horse, when he was struck and knocked down by an early (probably the first) flash of lightning. He soon recovered, but the horse was brought to its knees and killed instantaneously. It remained so rigid that after the cart had been removed it had to be shoved over on to its side.

JOHN HOPKINSON.

Weetwood, Watford, 9th February, 1906.

A storm of thunder, lightning and hail, lasting 15 minutes, passed overhead at 4 p.m. yesterday. The melted hail measured '11 in. The lightning struck a tree and a telegraph pole about one mile south of this place.

J. MASSON.

Tottingworth Park Gardens, Heathfield, Sussex, February 9th, 1906.

Correspondence.

THE PACKING OF METEOROLOGICAL INSTRUMENTS.

To the Editor of Symons's Meteorological Magazine.

THOSE of us who are privileged to control a meteorological service, however primitive it may be, find a deal to try our patience. Our troubles spring from many sources, but I wish to draw your attention to two, which may be interesting because they may not be so universal as other sources.

In the forefront of offenders I should place those who pack instruments for export. That the trouble is in the packer and not in the instruments is proved by my experience during the last few years in one of our colonies. I have had to unpack considerable quantities of apparatus for the teaching of Physics and Chemistry, such as a quadrant electrometer, several galvanometers, several Beckmann thermometers, X-ray tubes and glass ware of every description. The breakages have been few and trifling. But in the same time I have unpacked several consignments of meteorological instruments from several British firms and the number of breakages has been abnormally high. Fully fifty per cent. of the Kew barometers have been broken. Grass minimum thermometers especially suffer, the guard tube breaking. A nephoscope was packed with the compass needle *in situ* under the mirror! Result: a broken mirror, a broken agate and a broken pivot! One large case, containing a heterogeneous collection of rain gauges, an evaporation gauge, a barograph and a Campbell-Stokes sunshine recorder, came to hand with the packing sunk a good six inches below the lid. The evaporation gauge was beyond recognition, the barograph was so knocked about as to be almost useless. In another case a self-recording instrument had the drum removed, leaving the spindle projecting some three inches. It was bent through an angle of 30°. I need not mention breakages amongst such small fry as dry and wet bulb and maximum and minimum thermometers. They do not escape the general *débâcle*.

My advice to the packer is to take all instruments to pieces and pack the various pieces in small boxes, which may then be packed in one large case. This advice must be followed particularly in the case of so-called portable instruments. The ratio of packing material to instruments should be as 4 : 1.

Another source of trouble is the design of the instruments. The colony I speak of is exceedingly dry and dusty. The aforementioned nephoscope will illustrate what I mean, and the defect may be found also in theodolites, levels and dip needles. I refer to the electrification caused by wiping the mirror, even with one's hand. The compass needle being in close proximity to the mirror will point anywhere but North. In this connection I may tell you that in that climate black and bright bulbs may be tested for vacuum by simply drawing the hand over them. The whole interior glows like a Geissler tube, if the vacuum is good. The dry and wet bulb in the hands of an observer who simply takes readings must be a very misleading instrument, as between dust and drought the cotton cannot be relied on to keep the bulb wet.

Such a useful instrument as the Kew barometer is not reliable. I question if the constriction is worth retaining. It is there the tube breaks. The constriction must also be a cause of the sluggishness of the instrument. I have found a Fortin Standard more portable and more reliable in many ways.

A. W.

NOTE ON THE MODE OF FORMATION OF RAIN.

WHILST walking across the ridge of Ashdown Forest this morning in a storm of wind and rain, one of this prolonged series, I was especially struck both by the peculiar manner in which the rain seemed to grow out of the air, and by the apparent fact that the rain executed a complicated spiral movement before finally reaching the ground. I have repeatedly observed the phenomena to the best advantage perhaps among the higher hills of England which afford excellent back-grounds for observing similar effects. In such cases as this the eye can never, of course, attempt to analyse the motion of the rain drops, but it can perceive that it is of an exceedingly complicated nature.

It would seem that in cyclonic storms of this nature there is no line of demarcation between the rain zone and the cloud zone, the one merging imperceptibly into the other, rain being distinguished from cloud only by the greater size of the water-drops composing it. Very different is the rain which falls in showers and thunderstorms. Then the clouds seem to have some analogy to a saturated sponge, when it is suddenly compressed, the water falling in streams from this under surface, and the boundary between rain and cloud is often quite well defined by characteristic black streaks. Furthermore the cloud-density in heavy showers and thunderstorm rains must, on the whole, be very much greater than in the cyclonic rains of winter, and the inky-blackness of a thunder sky is very distinct from the dull grey-blackness of the more diffused clouds of large cyclonic storms.

L. C. W. BONACINA.

Forest Row, Sussex, January 18th, 1906.

GREEN FLASH AT SUNSET.

SURELY the phenomenon described by your correspondent, Admiral Maclear, is a physiological phenomenon of colour due to contrast. The green flash seen as the last ray of the setting sun disappears is the apparent image or spectrum of the sun which has just sunk below the horizon seen in the complementary green colour.

This phenomenon may be illustrated by the following experiment :—
 “ Let a small piece of bright red paper be held before a moderately lighted white surface ; let the observer look steadfastly at the small piece of coloured paper, and let it be taken away after a time, while his eyes remain unmoved ; a green spectrum will then be visible on the white surface. The coloured paper may also be left in its place, while the eye is directed to another part of the white surface, the same coloured appearance will be visible there too, for it arises from an image, which now belongs to the eye,” see Goethe, “ *Zur Farbenlehre*,” vol. i., pp. 49, 50, 54.

The reason why some observers may describe the colour of the flash as blue is due to the fact that the colour of the setting sun or planet is sometimes of a yellow-red or orange colour, the complementary colour of which is blue.

R. C. CANN LIPPINCOTT.

Over Court, Almondsbury, Bristol, January 20th, 1906.

WITH reference to “ the green flash,” I saw it continually on my way from Tasmania, in 1854, in the South Pacific. But it then occurred at *sunrise*. I used to get up to observe it morning after morning. I do not think I ever witnessed it at sunset.

GEORGE H. COURTENAY.

Southtown House, Kenton, nr. Exeter, January 19th, 1906.

[Major Courtenay's observation of the green ray at sunrise, *i.e.*, before the sun appears, seems to dispose of Mr. Lippincott's argument that the appearance is due to fatigue of the eye suggesting the complementary colour, a suggestion often made before seeing the phenomenon but rarely upheld by one who has actually observed it. We reserve further comment until the promised article on the subject appears.—Ed. *S.M.M.*]

ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on Wednesday, January 17th, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

The Council, in their Report, stated that the new scheme of Lectures and Exhibitions had been successfully inaugurated during the year, and that they had appointed Mr. W. Marriott as the Lecturer. The work of the Kite Committee had been continued, the special observations being carried out by Mr. G. C. Simpson, on board the mission steamer *Queen Alexandra* in the North Sea. The number of Fellows was 674, being an increase of 16 in the year.

The Report having been adopted and the usual votes of thanks passed, the President read from the Council minutes a statement of Lieut.-Gen. Sir Richard Strachey's services to Meteorology, and then in a few appropriate words handed the Symons Gold Medal to Dr. W. N. Shaw, on behalf of Sir R. Strachey, who had written expressing his great regret that he was unable to attend and receive it in person.

The President then delivered an address on "Meteorology in Daily Life." He referred to the increasing interest being shown throughout the country in the study of Meteorology, and to the recent advances which had been made in the science, more especially in the analysis of the composition of the atmosphere, and in the investigation of the upper air. He laid stress on the increasing urgency of safeguarding the water supply of the country, pointing out that, while in the reign of William the Conqueror there were barely two millions of inhabitants in these islands and no water was then used for sanitation or manufactures—to-day the population has risen to over forty-two millions, and a large proportion of the land had either been drained or built over. In the course of his address Mr. Bentley touched upon a large number of meteorological topics and gave various illustrations of the effects of weather on human life, animals, vegetation, agriculture, food, navigation, and railways.

A vote of thanks having been passed to the President for his address, the scrutineers of the ballot announced that the following gentlemen had been elected the Officers and Council for the ensuing year:—

President—Mr. R. Bentley. *Vice-Presidents*—Capt. W. F. Caborne, C.B., Mr. F. Druce, Sir J. W. Moore, and Capt. D. Wilson-Barker. *Treasurer*—Dr. C. T. Williams. *Secretaries*—Mr. F. C. Bayard and Dr. H. R. Mill. *Foreign Secretary*—Dr. R. H. Scott, F.R.S. *Council*—Mr. J. E. Clark, Mr. R. H. Curtis, Mr. W. H. Dines, F.R.S., Mr. W. Ellis, F.R.S., Capt. M. W. C. Hepworth, C.B., Mr. J. Hopkinson, Mr. R. Inwards, Mr. B. Latham, Mr. E. Mawley, Mr. H. Mellish, Dr. W. N. Shaw, F.R.S., and Mr. C. T. R. Wilson, F.R.S.

The Annual General Meeting was preceded by a brief Ordinary Meeting, at which the following gentlemen were elected Fellows:—Rev. I. K. Anderson, Sir Hugh Bell, Bart., Capt. F. Coode, Mr. C. H. Gott, Mr. C. H. Grant, Mr. M. W. Hilton-Simpson, Dr. K. W. Kumm, Mr. A. T. Millroy, and Mr. M. Thakado.

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## METEOROLOGICAL NEWS AND NOTES.

THE WEEKLY WEATHER REPORT of the Meteorological Office has undergone change and improvement with the beginning of the current year. The front page contains general remarks on the weather for the week over the British Isles and a general statistical summary of the temperature, rainfall and sunshine for each of the forecasting districts in three sections—the first dealing with the week just elapsed, the second with the season, the third with the current year—so far as they have respectively gone. The second page contains the values for the individual stations from which the summary has been compiled. The next three and a half pages contain, as formerly, three weather-maps of Europe for each day of the week just past, the map of temperature and weather at 8 a.m. and those of barometer and wind at 8 a.m. and 6 p.m. The second half of the last page is devoted to a supplementary table of sunshine, and—the most striking and valuable innovation—a table of observations in the upper air, taken by means of kites at the Meteorological Office's kite stations at Oxshott, and elsewhere during the week to which the Report refers. To all who have read Dr. Shaw's paper on "Seasons in the British Isles," recently published by the Royal Statistical Society, the new form of the Weekly Weather Report will appeal with special force.

THE SCIENCE YEAR BOOK, edited by Major B. F. S. Baden-Powell, is one of those books a review of which was crowded out of our last issue, but although it is now late in the year to invest in a diary, we can commend the text of this conveniently arranged hand-book as worth the cost of it. It contains a great amount of useful information and abounds with ingenious modes of arrangement, the originality and efficiency of which are very refreshing to meet with.

A LEADING ARTICLE IN "THE TIMES" of February 5th, calls attention to the harm that is done by the exaggerated ideas prevailing as to the frequency of destructive atmospheric disturbances. The particular case is one which admits of the only argument comes home to the unscientific mind, that of adding up and reducing to pounds, shillings and pence. Mr. Hesketh Bell, who had held an administrative office in the West Indies, pointed out that the rates of insurance against hurricanes were so high as to deter planters and farmers from protecting themselves against the calamitous results of these storms, and he showed that this arises from the exaggerated idea entertained by the insurance offices as to the frequency of hurricanes. In consequence of these representations new rates of insurance of crops in the West Indies against hurricanes, have been drawn up, bananas being excluded on account of their more ready destruction by wind, and it is believed that both planters and insurance companies will profit by the result.

CAN ANY OF OUR READERS tell us of a house with grounds suitable for kite experiments on a large scale, or near an expanse of open country in a thinly peopled district, within two hours by rail of London, as far as possible from the sea?

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## REVIEWS.

*Travaux de la Station Franco-Scandinave de Sondages aériens à Hald, 1902—1903.* [Work of the Franco-Scandinavian Station for aerial soundings at Hald for 1902—1903]. Viborg: 1904. Size  $12\frac{1}{2} \times 10$ . Pp. 52 + 162. Plates.

ON the initiative of M. Teisserenc de Bort it was resolved in 1901 to establish a station at which for several months continuous observations could be made, day and night, of the meteorological conditions of the upper air. The place selected for this purpose was Hald, near the little town of Viborg, in the centre of the peninsula of Jutland, and the governments of Denmark and Sweden assisted in the work, which was commenced in May, 1902, and continued for a whole year. M. Teisserenc de Bort writes the introduction to this report, Professor Hildebrandsson follows with an account of the organization of the station, which shows that half the cost was borne by M. Teisserenc de Bort, and that a Danish landed proprietor, Mr. A. Krabbe, gave the use of part of his estate free of charge for the installation of the station. Other participators in the work describe their special share. Various sheds, workshops, and a villa for the assistants were put up, and the complete staff included 6 meteorologists, 1 computer, 1 watchmaker, 5 mechanics, 1 foreman, 6 carpenters or kite makers, 6 men in three watches of two each, 1 coachman, and 1 labourer—a total of 28 all told.

Ascents were made almost every day and the kites were kept up for a very long time, frequently for more than twenty consecutive hours in a single experiment. *Ballons-sondes*, or small free balloons, carrying meteorographs with an arrangement to secure their fall after a definite interval of time, were also used, and of those sent up 80 per cent. were recovered. In addition, on several occasions ascents were made from ship-board in the adjacent sea. The bulk of the volume before us is occupied with the data of the various ascents reduced from the curves of the meteorographs, and it constitutes an immense storehouse of raw material for subsequent study.

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*Ueber die Energie der Stürme.* [On the Energy of Storms]. Von MAX MARGULIS. Wien: 1905. Size  $12 \times 9$ . Pp. 26.

THIS mathematical discussion of the energy of storms is reprinted from the annual publication of Central Institute for Meteorology in Vienna for 1903.

*The State of the Ice in the Arctic Sea, 1904.* [Copenhagen : 1905].

Size  $12 \times 9\frac{1}{2}$ . Pp. xvi. Plates.

THE Danish Meteorological Institute are punctual in the publication of this important series of monthly charts showing the distribution of ice in the North Atlantic and Arctic Sea during the open season of 1904. The winter of 1903-04 was found to be milder than usual to the north of the Atlantic, and in 1904 the East Greenland Current brought rather less and the Labrador Current considerably more ice than usual into the Atlantic.

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*The Floods of the Spring of 1903 in the Mississippi Watershed.* By

H. C. FRANKENFIELD. Washington Weather Bureau, 1904.

Size  $11\frac{1}{4} \times 9\frac{1}{2}$ . Pp. 64. Plates.

THE floods in question, produced by the heavy rainfall of February, 1903, affected the river for three months. The rise of water was unprecedented in many places, and the numerous photographs illustrating the memoir give a vivid idea of the damage done.

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*La représentation des situations atmosphériques.* Par A. BRACKE.

Mons : 1904. Size  $10 \times 6\frac{1}{2}$ . Pp. 32. Plates.

As heights in a country may be represented either by contour lines on a map or by a succession of sections, so M. Bracke proposes to represent atmospheric conditions by a series of sectional diagrams instead of the usual cartographic representation of isobars and isotherms.

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*La Théorie hydrothermodynamique des Tourbillons atmosphériques en face du problème des variations de la température de l'air.* [The hydro-

thermodynamic theory of atmospheric whirls and the problem of the variations of the temperature of the air.] Par R. P. MAX

DECHEVRENS, S.J. Jersey : 1905. Size  $8\frac{1}{2} \times 5\frac{1}{2}$ . Pp. 36.

IN 1879 Father Dechevrens put forward a theory of atmospheric whirls in which he looked upon the cyclone and anticyclone as parts of one whole, one being always superimposed upon the other and separated by a stratum of air at an elevation of from 18,000 to 21,000 feet. In 1886 he showed how mountain observations confirmed his view, and now he finds in the kite and balloon work recently undertaken still more ample confirmation of the correctness of a theory which proves applicable to all the facts regarding the distribution of temperature in cyclones and anticyclones at ground level and throughout all heights in the atmosphere.

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## TEMPERATURE FOR JANUARY, 1906.

| STATION.                            | COUNTY.            | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |        |      |        | No. of Nights<br>ator below 32° |        |
|-------------------------------------|--------------------|------------|----------------------|--------------------------------|--------------|--------|------|--------|---------------------------------|--------|
|                                     |                    |            |                      |                                | Max.         |        | Min. |        | Shade.                          | Grass. |
|                                     |                    |            |                      |                                | °            | Date.  | °    | Date.  |                                 |        |
| Camden Square.....                  | London.....        | 51 32      | 0 8                  | 111                            | 53.0         | 26     | 25.3 | 23     | 8                               | 16     |
| Tenterden.....                      | Kent.....          | 51 4       | 0 41                 | 190                            | 52.5         | 5      | 23.5 | 24     | 26                              | 15     |
| Hartley Wintney.....                | Hampshire.....     | 51 18      | 0 53                 | 222                            | 58.0         | 13, 14 | 24.0 | 23, 24 | 10                              | 12     |
| Hitchin.....                        | Hertfordshire..... | 51 57      | 0 17                 | 238                            | 51.0         | 4, 27  | 25.0 | 22, 23 | 8                               | ...    |
| Winslow (Addington).....            | Buckinghamsh. r.   | 51 58      | 0 53                 | 309                            | 53.0         | 27     | 26.0 | 20, 23 | 9                               | 18     |
| Bury St. Edmunds (Westley).....     | Suffolk.....       | 52 15      | 0 40                 | 226                            | 55.0         | 27     | 25.0 | 23     | 9                               | ...    |
| Brundall.....                       | Norfolk.....       | 52 37      | 1 26                 | 66                             | ...          | ...    | ...  | ...    | ...                             | ...    |
| Alderbury.....                      | Wiltshire.....     | 51 2       | 1 44                 | 263                            | 54.0         | 26     | 20.0 | 23     | 12                              | ...    |
| Winterbourne Steepleton.....        | Dorset.....        | 50 42      | 2 31                 | 116                            | 52.1         | 5      | 21.0 | 24     | 8                               | 10     |
| Torquay (Cary Green).....           | Devon.....         | 50 28      | 3 32                 | 12                             | 54.4         | 5      | 29.8 | 24     | 2                               | 15     |
| Polapit Tamar [Launceston].....     | ".....             | 50 40      | 4 22                 | 315                            | 54.1         | 5      | 22.8 | 24     | 7                               | 9      |
| Bath.....                           | Somerset.....      | 51 3       | 2 22                 | 67                             | 56.0         | 26     | 24.0 | 24     | 9                               | ...    |
| Stroud (Upfield).....               | Gloucestershire..  | 51 44      | 2 13                 | 226                            | 56.0         | 3 †    | 28.0 | 22     | 7                               | ...    |
| Church Stretton (Woolstaston).....  | Shropshire.....    | 52 35      | 2 48                 | 800                            | 51.0         | 26     | 22.5 | 1      | 18                              | ...    |
| Bromsgrove (Stoke Reformatory)..... | Worcestershire..   | 52 19      | 2 4                  | 225                            | 50.0         | 27     | 22.0 | 23     | 11                              | ...    |
| Boston.....                         | Lincolnshire.....  | 52 58      | 0 1                  | 25                             | 52.0         | 27     | 25.0 | 23     | 8                               | ...    |
| Worksop (Hodsock Priory).....       | Nottinghamshire    | 53 22      | 1 5                  | 56                             | 56.7         | 27     | 26.6 | 23     | 6                               | 22     |
| Derby (Midland Railway).....        | Derbyshire.....    | 52 55      | 1 28                 | 156                            | 54.0         | 27     | 24.0 | 23     | 6                               | ...    |
| Bolton (Queen's Park).....          | Lancashire.....    | 53 35      | 2 28                 | 390                            | 49.4         | 28     | 29.4 | 1      | 3                               | 15     |
| Wetherby (Ribston Hall).....        | Yorkshire, W.R.    | 53 59      | 1 24                 | 130                            | ...          | ...    | ...  | ...    | ...                             | ...    |
| Arnelliffe Vicarage.....            | ".....             | 54 8       | 2 6                  | 732                            | ...          | ...    | ...  | ...    | ...                             | ...    |
| Hull (Pearson Park).....            | " E.R.             | 53 45      | 0 20                 | 6                              | 54.0         | 28     | 30.0 | 20, 22 | 2                               | 19     |
| Newcastle (Town Moor).....          | Northumberland     | 54 59      | 1 38                 | 201                            | ...          | ...    | ...  | ...    | ...                             | ...    |
| Borrowdale (Seathwaite).....        | Cumberland.....    | 54 30      | 3 10                 | 423                            | 49.7         | 26     | 28.2 | 22     | 4                               | ...    |
| Cardiff (Ely).....                  | Glamorgan.....     | 51 29      | 3 13                 | 53                             | ...          | ...    | ...  | ...    | ...                             | ...    |
| Haverford west (High Street).....   | Pembroke.....      | 51 48      | 4 58                 | 95                             | 51.7         | 3      | 24.3 | 23     | 3                               | 12     |
| Aberystwyth (Gogerddan).....        | Cardigan.....      | 52 26      | 4 1                  | 83                             | ...          | ...    | ...  | ...    | ...                             | ...    |
| Llandudno.....                      | Carnarvon.....     | 53 20      | 3 50                 | 72                             | 57.0         | 4      | 34.0 | 1      | 0                               | ...    |
| Cargen [Dumfries].....              | Kirkcudbright..... | 55 2       | 3 37                 | 80                             | 52.0         | 27     | 28.0 | 22     | 4                               | ...    |
| Lilliesleaf (Riddell House).....    | Roxburgh.....      | 55 31      | 2 46                 | 550                            | 49.0         | 27     | 26.0 | 21     | ...                             | 23     |
| Edinburgh (Royal Observatory).....  | Midlothian.....    | 55 55      | 3 11                 | 442                            | 50.1         | 28     | 28.0 | 1      | 3                               | 8      |
| Colmonell (Clachanton).....         | Ayr.....           | 55 8       | 4 54                 | 140                            | 50.0         | 26, 28 | 26.0 | 21     | 2                               | ...    |
| Glasgow (Queen's Park).....         | Renfrew.....       | 55 53      | 4 18                 | 144                            | 49.0         | 26, 27 | 28.0 | 21     | 6                               | 26     |
| Tighnabruach.....                   | Argyll.....        | 55 55      | 5 14                 | 50                             | 44.0         | 3, 26  | 28.0 | 19, 21 | 7                               | 9      |
| Mull (Quinish).....                 | ".....             | 56 36      | 6 13                 | 35                             | ...          | ...    | ...  | ...    | ...                             | ...    |
| Dundee (Eastern Necropolis).....    | Forfar.....        | 56 28      | 2 57                 | 199                            | 53.2         | 26     | 27.0 | 22     | 8                               | ...    |
| Braemar.....                        | Aberdeen.....      | 57 0       | 3 24                 | 1114                           | ...          | ...    | ...  | ...    | ...                             | ...    |
| Aberdeen (Cranford).....            | ".....             | 57 8       | 2 7                  | 120                            | 57.0         | 26     | 28.0 | 7, 22  | 15                              | ...    |
| Cawdor (Budgate).....               | Nairn.....         | 57 31      | 3 57                 | 250                            | ...          | ...    | ...  | ...    | ...                             | ...    |
| Invergarry.....                     | E. Inverness.....  | 57 4       | 4 47                 | 130?                           | ...          | ...    | ...  | ...    | ...                             | ...    |
| Loch Torridon (Bendamph).....       | W. Ross.....       | 57 32      | 5 32                 | 20                             | ...          | ...    | ...  | ...    | ...                             | ...    |
| Dunrobin Castle.....                | Sutherland.....    | 57 59      | 3 56                 | 14                             | 54.5         | 26     | 28.0 | 8      | 14                              | ...    |
| Castletown.....                     | Caithness.....     | 58 35      | 3 23                 | 100                            | 47.0         | 21, 27 | 25.0 | 8      | 14                              | 16     |
| Killarney (District Asylum).....    | Kerry.....         | 52 4       | 9 31                 | 178                            | 55.0         | 29     | 29.0 | 20     | ...                             | ...    |
| Waterford (Brook Lodge).....        | Waterford.....     | 52 15      | 7 7                  | 104                            | 52.0         | 3 ‡    | 23.0 | 23     | 6                               | ...    |
| Broadford (Hurdlestown).....        | Clare.....         | 52 48      | 8 38                 | 167                            | 49.0         | 27     | 26.0 | 19, 22 | 6                               | ...    |
| Carlow (Browne's Hill).....         | Carlow.....        | 52 50      | 6 53                 | 291                            | ...          | ...    | ...  | ...    | ...                             | ...    |
| Dublin (Fitz William Square).....   | Dublin.....        | 53 21      | 6 14                 | 54                             | 54.9         | 28     | 29.0 | 23     | 2                               | 11     |
| Ballinasloe.....                    | Galway.....        | 53 20      | 8 15                 | 160                            | 58.0         | 27     | 24.0 | 20     | 16                              | ...    |
| Clifden (Kylemore House).....       | ".....             | 53 32      | 9 52                 | 105                            | ...          | ...    | ...  | ...    | ...                             | ...    |
| Crossmolina (Ennisiscoe).....       | Mayo.....          | 54 4       | 9 18                 | 74                             | ...          | ...    | ...  | ...    | ...                             | ...    |
| Seaforde.....                       | Down.....          | 54 19      | 5 50                 | 180                            | 52.0         | 26     | 27.0 | 20     | 5                               | 13     |
| Londonderry (Creggan Res.).....     | Londonderry.....   | 54 59      | 7 19                 | 320                            | ...          | ...    | ...  | ...    | ...                             | ...    |
| Edenfel.....                        | Tyrone.....        | 54 36      | 7 18                 | 280                            | 50.0         | 2 §    | 28.0 | 21     | 7                               | 13     |

† and 5, 26 and 27.

‡ and 4, 26 and

§ and 24, 26 and 28.

## RAINFALL FOR JANUARY, 1906.

| RAINFALL OF MONTH. |       |                    |          |                   |       |             | RAINFALL FROM JAN. 1. |       |                      |          | Mean Annual 1870-1899. | STATION.           |
|--------------------|-------|--------------------|----------|-------------------|-------|-------------|-----------------------|-------|----------------------|----------|------------------------|--------------------|
| Ver. 70-99.        | 1906. | Diff. from Av. in. | % of Av. | Max. in 24 hours. |       | No. of Days | Aver. 1870-99.        | 1906. | Diff. from Aver. in. | % of Av. |                        |                    |
| in.                | in.   |                    |          | in.               | Date. |             | in.                   | in.   |                      |          | in.                    |                    |
| 89                 | 4.02  | +2.13              | 213      | .74               | 12    | 18          | ...                   | ...   | ...                  | ...      | 25.16                  | Camden Square      |
| 36                 | 3.64  | +1.28              | 154      | .55               | 4     | 20          | ...                   | ...   | ...                  | ...      | 28.36                  | Tenterden          |
| 39                 | 4.34  | +1.95              | 182      | .69               | 16    | 22          | ...                   | ...   | ...                  | ...      | 27.10                  | Hartley Wintney    |
| 81                 | 3.54  | +1.73              | 196      | .53               | 4     | 20          | ...                   | ...   | ...                  | ...      | 24.66                  | Hitchin            |
| 05                 | 3.67  | +1.62              | 179      | .60               | 5     | 21          | ...                   | ...   | ...                  | ...      | 26.75                  | Addington          |
| 70                 | 3.64  | +1.94              | 214      | .50               | 4     | 22          | ...                   | ...   | ...                  | ...      | 25.39                  | Westley            |
| 67                 | 3.94  | +2.27              | 236      | .57               | 5     | 23          | ...                   | ...   | ...                  | ...      | 25.40                  | Brundall           |
| 67                 | 5.65  | +2.98              | 212      | .68               | 1     | 19          | ...                   | ...   | ...                  | ...      | 29.17                  | Aldbury            |
| 90                 | 8.91  | +5.01              | 228      | 1.42              | 2     | 24          | ...                   | ...   | ...                  | ...      | 39.00                  | Winterbourne Stptn |
| 19                 | 6.21  | +3.02              | 194      | .77               | 16    | 20          | ...                   | ...   | ...                  | ...      | 35.00                  | Torquay            |
| 87                 | 7.46  | +3.59              | 193      | .88               | 2     | 24          | ...                   | ...   | ...                  | ...      | 38.85                  | Polapit Tamar      |
| 52                 | 4.26  | +1.74              | 169      | .65               | 12    | 21          | ...                   | ...   | ...                  | ...      | 30.75                  | Bath               |
| 46                 | 4.71  | +2.25              | 191      | .69               | 5     | 21          | ...                   | ...   | ...                  | ...      | 29.85                  | Stroud             |
| 81                 | 4.16  | +1.35              | 148      | .85               | 5     | 23          | ...                   | ...   | ...                  | ...      | 33.04                  | Woolstaston        |
| 91                 | 3.54  | +1.63              | 185      | .59               | 5     | 18          | ...                   | ...   | ...                  | ...      | 24.50                  | Bromsgrove         |
| 59                 | 2.44  | + .85              | 153      | .40               | 6, 7  | 18          | ...                   | ...   | ...                  | ...      | 23.30                  | Boston             |
| 74                 | 2.91  | +1.17              | 167      | .56               | 7     | 17          | ...                   | ...   | ...                  | ...      | 23.70                  | Hodsock Priory     |
| 95                 | 3.28  | +1.33              | 168      | .66               | 5     | 23          | ...                   | ...   | ...                  | ...      | 26.18                  | Derby              |
| 38                 | 6.47  | +3.09              | 191      | .84               | 5     | 25          | ...                   | ...   | ...                  | ...      | 42.43                  | Bolton             |
| 89                 | 3.95  | +2.06              | 209      | .88               | 16    | 21          | ...                   | ...   | ...                  | ...      | 26.96                  | Ribston Hall       |
| 33                 | 9.96  | +3.63              | 157      | 1.82              | 28    | 28          | ...                   | ...   | ...                  | ...      | 60.96                  | Arnccliffe Vic.    |
| 80                 | 2.50  | + .70              | 139      | .44               | 5, 7  | 19          | ...                   | ...   | ...                  | ...      | 27.02                  | Hull               |
| 96                 | 2.42  | + .46              | 123      | .63               | 18    | 22          | ...                   | ...   | ...                  | ...      | 27.99                  | Newcastle          |
| 71                 | 19.93 | +5.22              | 135      | 6.15              | 28    | 28          | ...                   | ...   | ...                  | ...      | 132.68                 | Seathwaite         |
| 85                 | 7.57  | +3.72              | 197      | .80               | 5     | 26          | ...                   | ...   | ...                  | ...      | 42.81                  | Cardiff            |
| 13                 | 7.34  | +2.21              | 143      | 1.10              | 5     | 23          | ...                   | ...   | ...                  | ...      | 47.88                  | Haverfordwest      |
| 87                 | ...   | ...                | ...      | ...               | ...   | ...         | ...                   | ...   | ...                  | ...      | 45.41                  | Gogerddan          |
| 57                 | 3.88  | +1.31              | 151      | .91               | 5     | 21          | ...                   | ...   | ...                  | ...      | 30.98                  | Llandudno          |
| 54                 | 4.84  | + .30              | 107      | .92               | 28    | 24          | ...                   | ...   | ...                  | ...      | 43.43                  | Cargen             |
| 60                 | 2.98  | + .38              | 115      | .51               | 11    | 26          | ...                   | ...   | ...                  | ...      | 33.04                  | Riddell House      |
| ...                | 3.11  | ...                | ...      | .87               | 28    | 16          | ...                   | ...   | ...                  | ...      | ...                    | Edinburgh          |
| 52                 | 4.90  | + .38              | 108      | .60               | 14    | 25          | ...                   | ...   | ...                  | ...      | 44.85                  | Colmonell          |
| 25                 | 4.77  | +1.52              | 147      | .70               | 28    | 24          | ...                   | ...   | ...                  | ...      | 35.80                  | Glasgow            |
| 86                 | 7.20  | +1.34              | 123      | .67               | 11    | 27          | ...                   | ...   | ...                  | ...      | 57.90                  | Tighnabruaich      |
| 85                 | 6.81  | + .96              | 116      | 1.02              | 14    | 29          | ...                   | ...   | ...                  | ...      | 57.53                  | Quinish            |
| 10                 | 2.05  | + .05              | 98       | .45               | 28    | 15          | ...                   | ...   | ...                  | ...      | 28.95                  | Dundee             |
| 91                 | 3.63  | + .72              | 125      | ...               | ...   | ...         | ...                   | ...   | ...                  | ...      | 36.07                  | Braemar            |
| 32                 | 1.57  | + .75              | 68       | .34               | 3     | 14          | ...                   | ...   | ...                  | ...      | 33.01                  | Aberdeen           |
| 14                 | 2.76  | + .62              | 129      | .67               | 14    | 21          | ...                   | ...   | ...                  | ...      | 29.37                  | Cawdor             |
| 63                 | 12.73 | +6.10              | 192      | 2.15              | 24    | 20          | ...                   | ...   | ...                  | ...      | 56.00                  | Invergarry         |
| 75                 | 14.70 | +5.95              | 168      | 2.10              | 28    | 29          | ...                   | ...   | ...                  | ...      | 86.50                  | Bendamp            |
| 62                 | 2.87  | + .25              | 110      | .41               | 24    | 15          | ...                   | ...   | ...                  | ...      | 31.60                  | Dunrobin Castle    |
| ...                | 2.75  | ...                | ...      | .36               | 10    | 25          | ...                   | ...   | ...                  | ...      | ...                    | Castletown         |
| 57                 | 6.36  | + .21              | 97       | .84               | 11    | 25          | ...                   | ...   | ...                  | ...      | 58.11                  | Killarney          |
| 06                 | 4.86  | + .80              | 120      | .80               | 5     | 20          | ...                   | ...   | ...                  | ...      | 39.30                  | Waterford          |
| 98                 | 5.36  | +2.38              | 180      | .80               | 17    | 25          | ...                   | ...   | ...                  | ...      | 33.47                  | Hurdlestown        |
| 15                 | 3.86  | + .71              | 123      | .57               | 17    | 19          | ...                   | ...   | ...                  | ...      | 34.44                  | Carlow             |
| 16                 | 4.13  | +1.97              | 191      | .64               | 2     | 22          | ...                   | ...   | ...                  | ...      | 27.75                  | Dublin             |
| 49                 | 5.70  | +2.21              | 163      | .57               | 11    | 27          | ...                   | ...   | ...                  | ...      | 37.04                  | Ballinasloe        |
| 86                 | 11.08 | +3.22              | 141      | 1.33              | 15    | 25          | ...                   | ...   | ...                  | ...      | 80.23                  | Kylmore House      |
| 00                 | 7.08  | +2.08              | 142      | 1.27              | 11    | 27          | ...                   | ...   | ...                  | ...      | 50.50                  | Ennisceoe          |
| 63                 | 3.97  | + .34              | 109      | .67               | 7     | 24          | ...                   | ...   | ...                  | ...      | 38.61                  | Seaforde           |
| 56                 | 5.77  | +2.21              | 162      | 1.03              | 28    | 29          | ...                   | ...   | ...                  | ...      | 41.20                  | Londonderry        |
| 34                 | 5.34  | +2.00              | 160      | .70               | 14    | 27          | ...                   | ...   | ...                  | ...      | 37.85                  | Omagh              |

## SUPPLEMENTARY RAINFALL, JANUARY, 1906.

| Div.  | STATION.                          | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | 5.45            | XI.    | Rhayader, Tyrmynydd .....         | 11.18           |
| "     | Ramsgate, West Cliff Villas ..... | 2.18            | "      | Lake Vyrnwy .....                 | 9.30            |
| "     | Hailsham .....                    | 5.28            | "      | Llangyhanfal, Plas Draw .....     | 4.39            |
| "     | Crowborough, Uckfield Lodge ..... | 6.74            | "      | Criccieth, Talarvor .....         | 5.65            |
| "     | Osborne, Newbarn Cottage .....    | 7.05            | "      | Llanberis, Pen-y-pass .....       | 22.32           |
| "     | Emsworth, Redlands .....          | 7.73            | "      | Lligwy .....                      | 4.13            |
| "     | Alton, Ashdell .....              | 7.23            | "      | Douglas, Woodville .....          | 4.81            |
| "     | Newbury, Welford Park .....       | 5.55            | XII.   | Stoneykirk, Ardwell House .....   | 3.77            |
| III.  | Harrow Weald, Hill House .....    | 3.74            | "      | Dalry, The Old Garroch .....      | 8.59            |
| "     | Oxford, Magdalen College .....    | 3.16            | "      | Langholm, Drove Road .....        | 6.73            |
| "     | Bloxham Grove .....               | 3.97            | "      | Moniaive, Maxwellton House .....  | 5.73            |
| "     | Pitsford, Sedgebrook .....        | 3.79            | XIII.  | N. Esk Reservoir [Penicuik] ..... | 4.95            |
| "     | Huntingdon, Brampton .....        | 3.38            | XIV.   | Maybole, Knockdon Farm .....      | 4.21            |
| "     | Wisbech, Bank House .....         | 3.12            | "      | Campbeltown, Witchburn .....      | 5.52            |
| IV.   | Southend Water Works .....        | 3.09            | XV.    | Inveraray, Newtown .....          | 9.13            |
| "     | Colchester, Lexden .....          | 2.77            | "      | Ballachulish House .....          | 16.78           |
| "     | Newport, The Vicarage .....       | 3.55            | "      | Islay, Eallabus .....             | 6.12            |
| "     | Rendlesham .....                  | 3.54            | XVI.   | Dollar Academy .....              | 4.74            |
| "     | Swaffham .....                    | 3.65            | "      | Loch Leven Sluice .....           | 4.47            |
| "     | Blakeney .....                    | 3.23            | "      | Balquhiddier, Stronvar .....      | 12.96           |
| V.    | Bishops Cannings .....            | 3.97            | "      | Perth, Pitcullen House .....      | 3.30            |
| "     | Ashburton, Druid House .....      | 11.00           | "      | Coupar Angus Station .....        | 2.95            |
| "     | Okehampton, Oaklands .....        | 7.72            | "      | Blair Atholl .....                | 4.68            |
| "     | Hartland Abbey .....              | 6.13            | "      | Montrose, Sunnyside Asylum .....  | 2.02            |
| "     | Lynmouth, Rock House .....        | 7.59            | XVII.  | Alford, Lynturk Manse .....       | 1.97            |
| "     | Probus, Lamelllyn .....           | 6.10            | "      | Keith Station .....               | 1.23            |
| "     | Wellington, The Avenue .....      | 5.55            | XVIII. | N. Uist, Lochmaddy .....          | 3.43            |
| "     | North Cadbury Rectory .....       | 5.14            | "      | Alvey Manse .....                 | 2.82            |
| VI.   | Clifton, Pembroke Road .....      | 4.95            | "      | Loch Ness, Drumnadrochit .....    | 6.37            |
| "     | Moreton-in-Marsh, Longboro' ..... | 4.77            | "      | Glencarron Lodge .....            | 15.62           |
| "     | Ross, The Graig .....             | 4.08            | "      | Fearn, Lower Pitkerrie .....      | 1.89            |
| "     | Shifnal, Hatton Grange .....      | 3.42            | XIX.   | Invershin .....                   | 3.51            |
| "     | Cheadle, The Heath House .....    | 4.94            | "      | Altnaharra .....                  | 7.49            |
| "     | Coventry, Kingswood .....         | 3.59            | "      | Bettyhill .....                   | 3.81            |
| VII.  | Market Overton .....              | 4.00            | "      | Watten Station .....              | 1.86            |
| "     | Market Rasen .....                | 2.73            | XX.    | Dunmanway, The Rectory .....      | 8.92            |
| "     | Bawtry, Hesley Hall .....         | 2.36            | "      | Cork .....                        | 5.42            |
| VIII. | Neston, Hinderton .....           | 4.76            | "      | Darrynane Abbey .....             | 7.65            |
| "     | Southport, Hesketh Park .....     | 4.08            | "      | Glenam [Clonmel] .....            | 5.21            |
| "     | Chatburn, Middlewood .....        | 6.95            | "      | Ballingarry, Gurteen .....        | 4.07            |
| "     | Carmel, Flookburgh .....          | 5.83            | "      | Miltown Malbay .....              | 6.50            |
| IX.   | Langsett Moor, Up. Midhope .....  | 6.04            | XXI.   | Gorey, Courtown House .....       | 4.17            |
| "     | Scarborough, Scalby .....         | 4.51            | "      | Moynalty, Westland .....          | 4.56            |
| "     | Ingleby Greenhow .....            | 3.45            | "      | Athlone, Twyford .....            | 5.34            |
| "     | Mickleton .....                   | 3.49            | "      | Mullingar, Belvedere .....        | 4.29            |
| X.    | Bardon Mill, Beltingham .....     | 3.64            | XXII.  | Woodlawn .....                    | 6.59            |
| "     | Ewesley, Fallowles .....          | 3.45            | "      | Westport, Murriak Abbey .....     | 7.54            |
| "     | Ilderton, Lilburn Cottage .....   | 1.91            | "      | Collooney, Markree Obsy .....     | 5.92            |
| "     | Keawick, York Bank .....          | 8.85            | XXIII. | Enniskillen, Portora .....        | 4.06            |
| XI.   | Llanfrechfa Grange .....          | 7.53            | "      | Warrenpoint, Summer Hill .....    | 3.98            |
| "     | Treherbert, Tyn-y-waun .....      | 15.93           | "      | Banbridge, Milltown .....         | 2.58            |
| "     | Carmarthen, The Friary .....      | 8.09            | "      | Belfast, Springfield .....        | 4.72            |
| "     | Castle Malgwyn [Llachryd] .....   | 7.05            | "      | Bushmills, Dundarave .....        | 3.96            |
| "     | Plynlimon .....                   | 16.05           | "      | Stewartstown, The Square .....    | 3.54            |
| "     | Tall-y-llyn .....                 | 5.60            | "      | Killybegs .....                   | 7.75            |
| "     | New Radnor, Ednol .....           | 6.99            | "      | Horn Head .....                   | 6.97            |

## METEOROLOGICAL NOTES ON JANUARY, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Mild and excessively wet, the R having been only once exceeded and once equalled in January in 49 years. Mean temp.  $41^{\circ}9$ , or  $3^{\circ}8$  above the average. A short but violent TS occurred on 9th, accompanied by showers of H and great darkness, and there was again extraordinary darkness from 10 to 11.40 a.m. on 23rd. Duration of sunshine  $43^{\circ}3'$  and of R  $62^{\circ}5'$  hours, the latter being  $21^{\circ}2'$  hours above the average.

TENTERDEN.—Wet and warm with a great deal of wind. Duration of sunshine  $77\frac{1}{2}$  hours.

CROWBOROUGH.—Mild, stormy and wet. R  $3^{\circ}56$  in. above the average of 35 years and mean temp.  $40^{\circ}0$ , or  $3^{\circ}5$  above the average.

OSBORNE.—The largest R in any January in 48 years.

ADDINGTON MANOR.—The R was the largest with two exceptions yet recorded and big floods covered the meadows for days. The wind was often very high and several large trees were blown down.

BURY ST. EDMUNDS.—The wettest January in 50 years.

TORQUAY.—Duration of sunshine  $80^{\circ}5'$  hours, or  $17^{\circ}6'$  hours above the average. Mean temp.  $45^{\circ}4$ , or  $3^{\circ}1$  above the average. Mean amount of ozone  $5.5$ .

CLIFTON.—Wet and stormy till 18th owing to a series of depressions from the Atlantic. The remainder was fine but changeable. Very mild throughout. Tremendous gale from W. on the early morning of 6th, doing much damage to roofs and trees.

BOLTON.—Mean temp.  $40^{\circ}7$ , or  $2^{\circ}6$  above the average. Duration of sunshine  $19^{\circ}1'$  hours, or  $2^{\circ}2'$  hours below the average. The R was particularly heavy, but most of it fell during the nights, the day time being fair and often bright.

HAVERFORDWEST.—Mild with no extremes of temp. Severe gales, especially on 6th and 15th, with large R. Duration of sunshine  $49^{\circ}6'$  hours. Primroses, violets and other flowers in bloom.

DOUGLAS.—Wet, very mild and exceedingly stormy. Snowdrops, primroses, polyanthus and crocus were in flower, and currants and pears showed bloom unusually early. S on 18th with T, L and H.

LANGHOLM.—R  $2^{\circ}08$  in. above the average of 30 years.

COUFAR ANGUS.—Exceptionally mild, the mean temp. being  $39^{\circ}5$ , or  $4^{\circ}0$  above the average, making the second month in succession with abnormally high temp. Persistent wet weather.

DRUMNADROCHIT.—R  $2^{\circ}60$  in., and rainy days  $2^{\circ}5$ , above the average of 20 years, the amount being the greatest in that period except in 1903. Destructive flood on 14th caused by melting S on the hills. Floods again on 24th and 27th. Great damage to river banks, roads and cultivated land.

CASTLETOWN.—Open, dull and cloudy, with westerly winds, slight frosts and no S. Mean temp.  $36^{\circ}9$ . Shrubs beginning to sprout.

DARREYNANE ABBEY.—A wet month, especially in the first part, the fall up to 15th being equal to the average and the total 40 per cent. above the average, being exceeded only three times in 25 years.

DUBLIN.—W. and S.W. winds and heavy and frequent E with open but not warm weather. Mean temp.  $43^{\circ}9$ , or  $2^{\circ}3$  above the average. Atmospheric pressure was very unstable during the first three weeks.

BANBRIDGE.—R  $^{\circ}01$  in. below the average of 40 years.

OMAGH.—A saturating month with abnormal mildness. It could not be said that the ground was once wholly covered with S, and such frost as there was was of a light and ephemeral character.

\* Campbell-Stokes.

† Jordan

## Climatological Table for the British Empire, August, 1905.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain. |       | Aver.  |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|-------------|-------|--------|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.      | Days. | Cloud. |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |      |               |           |                 |                   |             |       |        |
| London, Camden Square                                            | 78.1      | 15    | 45.4     | 24    | 72.1     | 53.2 | 53.5          | 77        | 126.9           | 38.1              | 2.24        | 16    | 6.4    |
| Malta.....                                                       | 96.2      | 29    | 66.6     | 24    | 87.8     | 71.6 | 70.8          | 75        | 141.8           | 61.7              | .00         | 0     | 1.0    |
| Lagos.....                                                       | 84.0      | 17a   | 70.0     | 5b    | 81.5     | 72.8 | 70.1          | 76        | 140.0           | 62.0              | .49         | 7     | 7.5    |
| Cape Town .....                                                  | 76.4      | 11    | 38.2     | 15    | 60.6     | 46.2 | 45.8          | 73        | ...             | ...               | 3.06        | 14    | 4.0    |
| Durban, Natal .....                                              | 84.2      | 14    | 47.2     | 9     | 73.9     | 54.4 | ...           | ...       | 137.3           | ...               | 1.29        | 13    | 4.6    |
| Johannesburg .....                                               | 73.0      | 31    | 34.7     | 25    | 63.2     | 42.6 | 36.5          | 64        | 138.0           | 20.5              | .06         | 2     | 2.2    |
| Mauritius.....                                                   | 78.5      | 18    | 52.3     | 2     | 75.7     | 60.6 | 58.9          | 74        | 140.8           | 44.9              | 2.35        | 14    | 6.3    |
| Calcutta.....                                                    | 91.5      | 24    | 74.9     | 13    | 88.6     | 79.7 | 78.4          | 86        | 158.1           | 73.4              | 6.31        | 15    | 8.6    |
| Bombay.....                                                      | 87.6      | 31    | 75.3     | 24    | 85.6     | 77.9 | 76.0          | 83        | 135.0           | 73.8              | 4.35        | 28    | 8.2    |
| Madras.....                                                      | 101.2     | 21    | 72.7     | 2     | 95.4     | 77.8 | 72.6          | 72        | 151.3           | 71.3              | 1.92        | 11    | 5.8    |
| Kodaikanal.....                                                  | 68.4      | 6     | 50.1     | 4     | 64.4     | 52.7 | 51.1          | 80        | 144.6           | 40.4              | 8.54        | 17    | 6.5    |
| Colombo, Ceylon.....                                             | 89.0      | 7     | 76.5     | 22    | 87.5     | 78.7 | 74.5          | 80        | 153.5           | 74.8              | .59         | 10    | 6.0    |
| Hongkong.....                                                    | 90.5      | 14    | 73.0     | 1     | 86.7     | 77.3 | 75.7          | 84        | 146.8           | ...               | 12.12       | 15    | 6.8    |
| Melbourne.....                                                   | 65.5      | 4, 25 | 32.0     | 2     | 58.3     | 43.0 | 40.4          | 71        | 120.0           | 24.5              | 1.33        | 12    | 6.2    |
| Adelaide.....                                                    | 68.8      | 4     | 34.8     | 21    | 59.5     | 43.5 | 41.8          | 71        | 126.3           | 30.3              | 1.48        | 13    | 5.4    |
| Coalgardie.....                                                  | 76.0      | 31    | 32.4     | 11    | 62.4     | 39.3 | 36.7          | 58        | 144.9           | 24.6              | .54         | 4     | 2.8    |
| Sydney.....                                                      | 76.9      | 20    | 40.4     | 10    | 62.4     | 46.4 | 41.2          | 72        | 109.8           | 30.5              | .63         | 22    | 3.1    |
| Wellington.....                                                  | 62.8      | 16    | 32.5     | 30    | 54.2     | 43.2 | 39.1          | 69        | 109.0           | 28.0              | 2.73        | 19    | 6.1    |
| Auckland.....                                                    | 60.5      | 19    | 39.5     | 11    | 56.9     | 46.2 | 45.8          | 82        | 115.0           | 36.0              | 3.05        | 15    | 5.7    |
| Jamaica, Negril Point..                                          | 91.0      | 21    | 71.3     | 29    | 87.8     | 73.9 | 73.8          | 78        | ...             | ...               | 5.45        | 10    | ...    |
| Trinidad.....                                                    | ...       | ...   | ...      | ...   | ...      | ...  | ...           | ...       | ...             | ...               | ...         | ...   | ...    |
| Grenada.....                                                     | 89.4      | 13    | 71.0     | 31    | 84.5     | 75.0 | 72.0          | 78        | 143.4           | ...               | 11.64       | 25    | 3.4    |
| Toronto.....                                                     | 83.8      | 10    | 48.9     | 17    | 77.4     | 57.7 | 59.0          | 76        | ...             | 36.8              | 4.22        | 4     | 4.4    |
| Fredericton .....                                                | 88.7      | 12    | 35.4     | 15    | 75.6     | 49.5 | 50.8          | 56        | ...             | ...               | 1.60        | 8     | 5.2    |
| Winnipeg.....                                                    | 84.4      | 22    | 43.5     | 31    | 76.5     | 54.4 | ...           | ...       | ...             | ...               | 1.41        | 12    | 5.5    |
| Victoria, B.C. ....                                              | 78.4      | 8     | 46.9     | 25    | 65.9     | 52.9 | ...           | ...       | ...             | ...               | 1.21        | 7     | 3.7    |
| Dawson.....                                                      | 80.0      | 1     | 26.4     | 27    | 66.4     | 44.3 | ...           | ...       | ...             | ...               | 2.51        | 9     | 5.2    |

a and 21. b and 9, 27.

MALTA.—Mean temp. of air 79°·1, or 1°·0 above average. Mean temp. of sea 81°·7.

Durban.—E .64 in. below the average of 30 years.

MAURITIUS.—Mean temp. of air 0°·3, and dew point 0°·5 below, and E .09 in. above, averages. Mean hourly velocity of wind 9.8 miles, or 2.5 below average.

MADRAS.—Deficient E, with persistent N.W. winds. Bright sunshine 154.2 hours.

KODAIKANAL.—Bright sunshine 150 hours. Very many TSS.

COLOMBO.—Mean temp. of air 82°·4, or 1°·6 above, of dew point 1°·3 above, and E .31 in. below, averages. Mean hourly velocity of wind 10.0 miles.

HONGKONG.—Mean temp. of air 81°·2. Mean direction of wind E.S.E., and mean hourly velocity 9.3 miles. Bright sunshine 223.4 hours.

ADELAIDE.—Mean temp. of air 2°·4 below, E .84 in. below 48 years' average. The coldest August, with one exception (1872, 49°·9).

SYDNEY.—E 2.54 in. below; mean temp. 0°·4 below, average.

WELLINGTON.—E 2.31 in. below average.

AUCKLAND.—E 1.25 in. below average.

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## THE GREEN FLASH ON THE HORIZON.

By ARTHUR A. RAMBAUT, D.Sc., F.R.S.

Is the "green flash" at sunset a real objective change in the character of the light which reaches us from the sun just before its disappearance, or is it a subjective effect due to fatigue of the retina?

Several references to this interesting occurrence have lately appeared in the pages of *Symons's Meteorological Magazine*, and a good deal of doubt seems to be entertained in some quarters as to its objective character. It will, therefore, be well to examine what is known about it.

Of recent years this phenomenon has been frequently observed, and many descriptions of it will be found scattered through the pages of various scientific periodicals. The first account of the appearance, with which I am acquainted, is published in *Nature*, Vol. 29, p. 7. The Rev. G. H. Hopkins, of Week St. Mary Rectory, Cornwall, writes—"In a clear sky, as the disk of the sun sinks down below the horizontal line of the ocean, the parting ray is a brilliant emerald green. I have occasionally, but not often, had the pleasure of seeing this interesting phenomenon, as the clear atmosphere has to be accompanied with a cloudless region of the sky where the sun is setting. The same effect is not produced by the sun setting behind a distant bank of clouds. Probably the first ray from the rising sun would be the same unexpected colour."

On p. 76 of the same volume Mr. William Swan describes a similar appearance as seen by him at sunrise from the summit of the Rigi on September 13th, 1865. He writes—"The very first rays, although necessarily proceeding from the comparatively obscure limb of the sun, were dazzlingly brilliant and of a superb emerald green colour . . . . In *Nature*, Vol. xli. p. 495, will be found a notice of Prof. Sohncke's views with regard to the phenomenon, and on p. 538 of the same volume is a letter from Prof. Michie Smith dealing with the subject. Quite a number of references to the "green flash" will be found scattered through the pages of the *Journal of the British Astronomical Association*. The following list of the places where they occur (in which the volumes of the *Journal* are denoted by Roman, the pages by Arabic, numbers) may be found useful:—vii., 514; viii., 95 and 190; x., 364; xi., 75; xii., 32, 218, 248 and 289; xiii., 382; xv., 265, 366 and 382; and xvi., 23. The observa-

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tion described by Mr. Whitmell at p. 289, vol. xii. (included in the above list) is particularly interesting and will engage our attention later. Notices will also be found in *Knowledge*, April, 1889, p. 126, and in the *Monthly Notices* of the *Royal Astronomical Society*, Vol. lxi. pp. 484 and 629, besides the references to the subject which have appeared in this Magazine for January and February of this year.

I had often looked for this phenomenon, but never until last autumn had I been so fortunate as to get a view of it. When starting, as a member of the British Association, on the expedition to South Africa in July last, this was one of the many unfamiliar objects which I looked forward to seeing; but although I was generally on the look out at the time of sunset, whether the sun went down behind a sea horizon, or sank into the apparently interminable veldt, it was not until the evening of September 27th, when the sun set behind the grand range of hills terminating in Cape Guardafui, that I saw the "green flash." It was then quite unmistakable, and those who are so fortunate as to see it, as I and several of my fellow-passengers on the *Durham Castle* did on that occasion, will not, I think, retain any lingering doubts as to the objective character of the phenomenon.

On that evening I was using a good pair of field-glasses by Ross, and watched the sun's disk as it sank lower and lower behind the outline of the hills. When the visible portion of the disk was reduced to a very narrow elongated segment I could distinctly see that the tips of the segment first became green, whilst the central portion still remained a brilliant yellow or orange. As the segment became more attenuated, the green patches spread rapidly from each end, until, meeting in the middle, they merged into each other and the whole narrow segment appeared of a vivid green or bluish tint. This lasted for a very short time, the length of which I made no attempt to estimate, and then entirely disappeared.

After that date the phenomenon became one of frequent, almost daily, occurrence as we passed northwards through the Red Sea, and was observed by many of the passengers on board the *Durham Castle*. It was seen both with and without glasses, but to enable one to follow the gradual extension and meeting of the green tips some little optical aid seems necessary. The majority of the passengers, many of them well known astronomers and meteorologists, were thoroughly convinced of the objective reality of the phenomenon. Of course, as might be expected in such a large lumber, there were found a few sceptics. These were, for the most part, inclined to look for a physiological explanation of the phenomenon, and to attribute it to fatigue of the retina. Looking over the literature of the subject it appears to me now that the number of observations recorded of the "green flash" at *sunrise* afford a complete refutation of the physiological theory, but at the time I was not so familiar with what had been written on the subject as I have since become, and in order to test the physiological hypothesis I observed the

sunrise on several mornings in succession, and I am very glad to be able to add my testimony to that of Major Courtenay and others who have watched the sun under similar circumstances. On the morning of September 29th I was rewarded by a magnificent exhibition of the "green flash" at sunrise which appears to me to dispose absolutely of the "fatigue" argument. On that occasion I was sitting beside Prof. H. A. Miers, Professor of Mineralogy at Oxford, near the stern of the vessel, and at my request he also watched for the first appearance of the sun above the horizon. I was using my glasses, and as the east brightened I concluded, from the brilliance of the sky above one particular part of the horizon, that the sun was just about to make its appearance at that spot, and kept the glasses directed upon it. I was, however, mistaken, and, while I was thus watching, Prof. Miers exclaimed, "There it is." I instantly swept the horizon till I found the sun, losing a fraction of a second in doing so, but nevertheless, when I found it, though the segment was then rapidly widening and had already become yellow about the middle, I could yet see the long vividly green points separating rapidly and shrinking in size until the greenness entirely disappeared. I am authorised by Prof. Miers to state that the first ray as seen by him with the naked eye was of a brilliant green colour, while another distinguished scientist who was standing by preferred to describe it as blue. On October 2nd I again saw the "green flash" at sunrise.

Remarking that the "green flash" is not usually found to occur when the sun is strikingly red before setting (a clear horizon with a minimum amount of atmospheric absorption, and consequently a yellow sun, appearing to be the most favourable conditions for the occurrence of the flash), and that violet, not green, is the colour complementary to yellow, we should expect the sunset flash, if it were due to fatigue, to be on the violet, rather than the green, side of blue, but it is difficult to see how the eye could possibly be fatigued in such a way as to bring about the appearance of a green flash at sunrise.

We must, therefore, look for the explanation in another direction.

The obvious explanation, and one that seems quite sufficient to account for all the observed facts, is that the "green flash" is due to the unequal refraction experienced by rays of different colours in passing through the Earth's atmosphere. It is a well-known fact that the setting sun has actually sunk completely beneath the horizon at the moment when it appears to us to be first in contact with it, and when the upper limb is just about to disappear it is actually 36' below the horizon. We see it in virtue of the refraction which bends the rays round the horizon so as to reach our eyes. The red being the least refrangible is the first to be lost, and the different colours of the spectrum vanish one by one in the order—red, orange, yellow, green, blue, indigo and violet.

*(To be continued.)*



## A RECORDING ANEMOMETER FOR KITES.

BY W. H. DINES, F.R.S.

IN the July number of this Magazine for 1904 (Vol. 39, p. 109), a meteorograph designed for use with kites was described. Lately an arrangement for recording the velocity of the wind has been added to it.

This is effected by registering on the sheet the tension of a length of sewing cotton, to the end of which a small light sphere of about 3 inches diameter is secured. About 40 ft. of cotton are used, so that the ball may be far from the kite and out of the way of the disturbance it causes to the air motion. The pressure upon the ball in pounds is calculated by the formula,  $P = .0015 A \cdot v^2$ , where  $A$  is the cross section of the ball in square feet and  $v$  the velocity of the wind in miles per hour. Since the weight of the ball acts vertically and the wind pressure horizontally, the tension of the cotton is given by the expression  $\sqrt{W^2 + P^2}$ , where  $W$  is the weight of the ball. The values of this for 10, 20, 30, etc., miles per hour are calculated, and weights corresponding to each value cut from a piece of lead tube. The mode of registration is shown in fig. 1. An

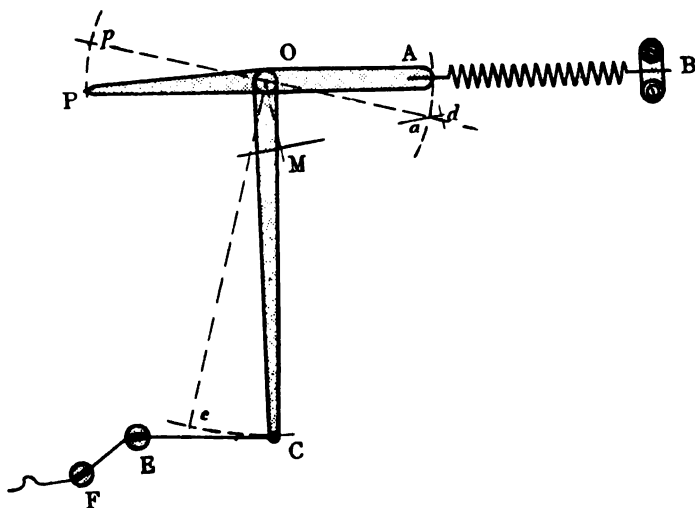


FIG. 1.—REGISTERING ARRANGEMENT OF KITE ANEMOMETER.

arm, A O P, with a pen at P, is pivoted at O, and another arm, O C, is rigidly attached to it. The cotton is tied to the point C and passes through the two guides E and F, thence running freely through the bottom cell of the kite to the ball. A spiral spring of hard German silver wire is soldered to the arm at A and clamped in position at B. The cotton being pulled so that C comes to c, the

pen arm takes the position  $p O a$ , and the spring is extended through a length,  $d a$ . The force so produced is proportional to the extension, and it acts at the point  $M$ , so that the effective moment of the spring tending to draw back the pen is proportional to  $O M \times a d$ ; and for small deflections this is proportional to  $(P p)^3$ . There is also the force required to bend the spring into the position  $A d$ , apart from its extension, but this is of comparatively little consequence.

Toy celluloid balls weighing some 175 grains, a trifle under 3 inches diameter, are obtainable at most toy shops. With such a ball, the weights for 0, 10, 20, etc., miles per hour are about 175, 184, 268, 486, 820, 1260, 1810 grains. These balls give a reliable scale for values over 20 miles per hour. They are far stronger than is required and it should be possible to get much lighter ones specially made. With half the weight, the record would be reliable to 15 miles, which would suffice for work with kites.

The velocities are calculated for an air pressure of 30 inches of mercury, and an allowance must be made for decrease of density. This may be done approximately up to 10,000 feet by adding  $1\frac{1}{2}$  per cent. to the velocity for each 1000 feet of vertical height.

The scale is obtained by hanging the weights previously mentioned to the end of the lever and marking the corresponding position of the pen. It has been found that the velocities thus recorded, or rather thus deciphered, have been in close agreement with the velocities obtained by cloud observations, whenever the latter have been available.

The upper wind is much steadier than that near the surface, and very little difficulty has been experienced from the oscillation of the pen. To check the oscillation the two guides,  $E$  and  $F$ , are placed so that  $F E C$  is not a straight line, and the departure from straight-

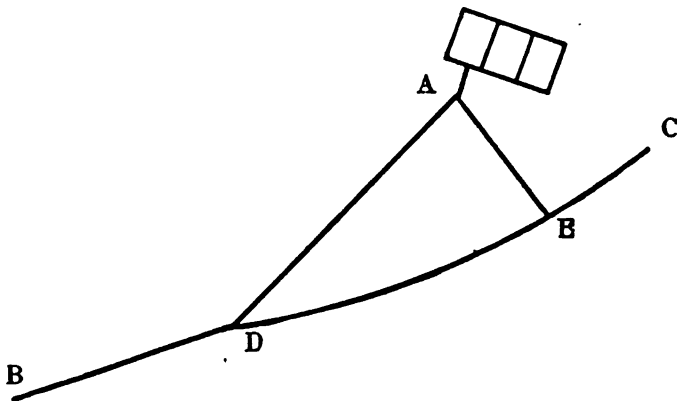


FIG. 2.—METHOD OF ATTACHING SUPPLEMENTARY KITE.

ness is easily arranged so that the friction of the cotton on the guides may check the oscillations, but yet allow every variation of the wind to be followed by the pen. Fresh cotton is used for each ascent, and no trouble has been found in starting the kite with the ball trailing out behind.

A plan of attaching a supplementary kite to the line, which avoids all risk of fouling, has been adopted with good results. The supplementary kite A (fig. 2) is attached to the line BC by 30 feet of strong cord tied to a clamp at D. A second clamp is placed at E, so that  $DE = 30$  feet, and A and E are kept apart by a light bamboo some 10 feet long. DA and DE are not necessarily 30 feet, but must be of nearly equal length, and 30 feet is the length that has been used. Of course the bamboo is an objection in that it offers some resistance to the wind, but the resistance is not great. There always used to be anxiety with a second kite lest the wind should temporarily fail and allow the kite to drop on to or under the main wire and foul it, but with the present arrangement this cannot occur, since the bamboo in such a case pushes the wire out of the way.

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### ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting was held on Wednesday evening, February 21st, at the Society's Rooms, 70, Victoria Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. E. Mawley read his "Report on the Phenological Observations for 1905." He said that as affecting vegetation the weather of the phenological year ending November, 1905, was chiefly remarkable for the dryness and mildness of the winter months, the drought and frosts in May, the long spell of hot and dry weather in July, and an exceptionally cold period in October. Wild plants came into flower a few days earlier than usual until about the beginning of May, after which time they were as a rule late to about the same extent. Most of the early spring migrants, such as the swallow and nightingale, reached these shores in advance of their average dates. The best farm crops of the year were those of wheat, beans and hops, while barley, potatoes, turnips and mangolds were all more or less over average. On the other hand, the yield of oats, peas and hay was almost everywhere deficient—the last being the worst crop of the year. Apples, pears and plums were below average in all parts of the British Isles, whereas the small fruits as a rule yielded well. Taking the farm crops alone, the past year must be regarded as having been on the whole a fairly bountiful one.

Mr. F. C. Bayard referred to the destruction of bud and blossom by wild birds.

Mr. J. E. Clark stated that he had noticed that, besides the apple crop being poor, the fruit was keeping badly. This was especially marked in Somerset, the county of the apple. He also said that, in

spite of the severe frost of last October, at Christmas time there were found in the Croydon district thirty-three species of wild plants in bloom as compared with only seven in the previous year, and of garden varieties fifteen were seen as against seven at Christmas, 1904.

Mr. C. Harding said that Mr. Mawley had now worked up the phenological observations for so long a period that he hoped he would soon forecast the seasons and say whether we were likely to have good or bad crops.

Mr. H. Southall, Mr. J. Hopkinson, Mr. F. Druce, Mr. D. W. Horner, and Mr. N. Farrington, also took part in the discussion.

Mr. Mawley, in reply, said that no doubt the reason why the apples were keeping so badly was that the dull and cold autumn had prevented the fruit from ripening sufficiently.

The President endorsed what had been said about the destruction of buds and blossoms by small birds, as in his neighbourhood in Buckinghamshire they had wrought considerable damage, especially the bullfinches and sparrows. He thought it would be of immense value if accurate forecasts of frosts in the spring months could be established in this country. He had note of one such forecast in California, which, by the farmers taking the necessary precautions, had been the means of saving thousands of dollars.

The other papers read were :—" Brief Discussion of the General Features of the Pressure and Wind Conditions over the Trades-Monsoon Area," by Mr. W. L. Dallas ; and " The Dispersal or Prevention of Fog," by Dr. W. B. Newton.

The following gentlemen were elected Fellows of the Society :— Mr. C. A. Cheyne, Mr. O. Fulton, Lieut.-Col. G. M. J. Giles, Mr. A. J. V. Rapkin, Mr. W. H. Taylor, and Mr. J. W. White.

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## Correspondence.

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*To the Editor of Symons's Meteorological Magazine.*

### HYDROTHERMODYNAMIC THEORY.

I AM grateful for the short analysis of the *Théorie hydrothermodynamique des tourbillons atmosphériques*, which appeared in the last number of the Magazine, but permit me to correct a statement that may lead to a misunderstanding of the constitution of atmospheric whirls according to this theory.

All of us know well the distinct and separate existence of the cyclone and the anticyclone. The analysis referred to attributes to me the assumption that "the cyclone and the anticyclone are parts of one whole, one being always superimposed upon the other and separated by a stratum of air at an elevation of from 18,000 to 21,000 feet." This is too concise to be intelligible.

There are two distinct whirls at the surface of the Earth—one converging, the cyclone, the other diverging, the anticyclone. But both are double in height, and the two superimposed whirls are always symmetrically disposed by their vertical constitutive currents; thus, the superior cyclone is descending as an inferior anticyclone, and the superior anticyclone is ascending as an inferior cyclone.

The existence of these two superimposed and symmetrical whirls is a natural, physical and logical consequence of the fact that the primary cause of the trouble in the air and of the low pressure in the cyclone and of the high pressure in the anticyclone, is to be searched for in the middle region, not at the surface of the Earth. For if that trouble engenders in the subjacent and depressed masses a gyratory motion with ascending current, it necessarily engenders in the superjacent ones a similar gyration with descending current. On the other side, if the masses of air abstracted out of the cyclone in that middle region accumulate finally, as they do, in another part of the same stratum, the resulting overpressure makes the subjacent masses to descend and the superjacent to ascend.

Now the descending whirl upon the cyclone is not a true anticyclone, and the ascending one upon the anticyclone is not a true cyclone, because the first is a column of low pressure continuing the inferior cyclone, and the second a column of high pressure continuing the inferior anticyclone.

This last assumption is the more important as one seems to have groundlessly contradicted or not exactly studied it. I think I have put it in full light in the *Théorie hydrodynamique*, and recently in the Bulletin of the Jersey Observatory for 1905, in a note *Sur la Pression et la Température dans les Cyclones et dans les Anticyclones: réponse à M. J. Hann.*

MARC DECHEVRENS, S.J.

*Observatoire St. Louis, Jersey, 18th February, 1906.*

## LOCALIZATION OF SNOW ON THE SURREY HILLS, ON FEBRUARY 24th, 1906.

THE distribution of snow-covered ground was very peculiar in the neighbourhood of Dorking on February 24th, showing a relationship, real or apparent, with the geological character of the district.

The chalk of Box Hill and of the North Downs generally to the north of the town was, so far as I could see, completely destitute of snow, the sandy tract of Ranmore Common to the north-west was snow-clad in patches, whilst the sandstone uplands of Leith Hill, together with the adjacent meadows below to the south-west, were covered to a depth varying from two to three inches, and the bare boughs of rugged oaks in meadow and woodland were decked with snow in a beautiful manner. Either the snow-fall which was experienced very generally in the counties south of the Thames in the

early morning of the 23rd had been much heavier towards the south-west of Dorking than towards the north-east, or else a rapid thaw had set in on the chalk hills in the latter direction. Unfortunately, I was quite unprepared to find much snow in Surrey on the date in question, so that within the limits of a few hours I was unable to make such detailed and accurate observations upon the distribution of the covering of snow in relation to the nature of the subjacent rocks as I should otherwise have made; but perhaps readers who may happen to reside in the Dorking district or anywhere along the strip of the upper greensand formation beneath the chalk escarpment, say from Guildford to Sevenoaks, could add to the above remarks concerning the distribution of snow-covered ground on the 23rd and 24th. I do not know whether the subject of the influence which different species of rock in virtue of their different physical constants may exert upon the permanence of a superincumbent layer of snow has yet been submitted to mathematical investigation. In the present connection a comparison, could it have been made, of the temperature before the snow-fall, on and below the surface of the chalk and sandstone of Box Hill and Leith Hill respectively would probably have yielded interesting results, as also would a comparison of the state of the rocks with respect to saturation.

L. C. W. BONACINA.

*Hampstead, N. W., Feb. 25th, 1906.*

[Was the snow absent from the northern slopes of the North Downs, and was it present on the southern slopes of Leith Hill? In other words, was the distribution not due to exposure to the sun rather than to conduction from the rock?—ED. *S.M.M.*]

### THE GREEN FLASH.

EXCUSE my observing that Major Courtenay does not say that he saw the green flash before the sun rose above the horizon.

As soon as the whole or a portion of the sun's disc becomes visible at sunrise, the eye will be impressed by the colour of the disc, and exhibit its vital elasticity by producing out of itself the demanded colour, which, if the sun is red, will be green.

Even while the sun is still below the horizon, it is announced by a red light, which colours the atmosphere and tinges the clouds in the neighbourhood. This red light is sufficient to stimulate the retina to produce the opposite colour.

R. C. CANN-LIPPINCOTT.

*Over Court, Almondsbury, Bristol, 20th Feb., 1906.*

[We hope next month to publish the conclusion of Dr. Rambaut's article on the Green Flash, and subsequently to summarize the interesting correspondence which Admiral Maclear's recent letter has called forth.—ED. *S.M.M.*]

## HIGH TEMPERATURES IN MARCH.

PERHAPS the following abnormally high maximum readings for the season may be of interest. Equally high temperatures were last recorded here in the first week of September. On 6th and 7th inst. there was also heavy dew by 9.0 p.m.

The instruments are Kew verified.

|         |       | Max. in<br>Screen. | Solar Radiation<br>(b. b. in v.) |
|---------|-------|--------------------|----------------------------------|
| March 6 | ..... | 64°·0              | 105°·3                           |
| „ 7     | ..... | 65°·6              | 107°·5                           |

W. J. CARTER.

Montem Road, New Malden, Surrey, 9th March, 1906.

## SYDNEY CLIMATOLOGICAL NORMALS.

WE have been favoured with a copy of the summarized climatological observations taken at the Government Observatory at Sydney, New South Wales, during the 46 years 1859 to 1904, containing the averages of the usual meteorological elements and the extreme values noted during that period. Of these averages the most important are quoted in the following table:—

|                  | Jan.   | Feb.   | Mar.   | Apr.   | May.   | June.  | July.  | Aug.   | Sept.  | Oct.   | Nov.   | Dec.   | YEAR   |
|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                  | in.    | in.    | in.    | in.    | in.    | in.    | in.    | in.    | in.    | in.    | in.    | in.    | in.    |
| Barometer (cor.) | 29·929 | 29·973 | 30·054 | 30·103 | 30·091 | 30·036 | 30·115 | 30·103 | 30·045 | 30·001 | 29·981 | 29·918 | 30·020 |
| Aver. Mean Max.  | 78°·2  | 77°·2  | 75°·4  | 70°·8  | 64°·8  | 60°·4  | 58°·9  | 62°·2  | 66°·3  | 71°·0  | 74°·2  | 77°·1  | 68°·7  |
| Shade Temp.      | 64°·8  | 64°·8  | 63°·1  | 58°·2  | 52°·0  | 48°·2  | 45°·7  | 47°·5  | 51°·4  | 55°·9  | 59°·6  | 62°·8  | 56°·2  |
| Mean Min.        | 51°·4  | 51°·8  | 50°·9  | 48°·3  | 44°·2  | 39°·9  | 37°·3  | 37°·5  | 40°·3  | 43°·3  | 46°·7  | 49°·4  | 45°·1  |
| Shade Temp. of   | 71°·4  | 71°·8  | 70°·9  | 68°·3  | 64°·2  | 59°·9  | 57°·3  | 57°·5  | 60°·3  | 63°·3  | 66°·7  | 69°·4  | 65°·1  |
| Sea.....         | 71°·4  | 71°·8  | 70°·9  | 68°·3  | 64°·2  | 59°·9  | 57°·3  | 57°·5  | 60°·3  | 63°·3  | 66°·7  | 69°·4  | 65°·1  |
| Wind             | mi.    | mi.    | mi.    | mi.    | mi.    | mi.    | mi.    | mi.    | mi.    | mi.    | mi.    | mi.    | mi.    |
| Movement...      | 8010   | 6447   | 6473   | 5896   | 6046   | 6893   | 6978   | 6678   | 6944   | 7284   | 7426   | 7629   | 6864   |
| Rainfall ...     | 3·57   | 4·88   | 5·10   | 5·63   | 5·24   | 5·51   | 4·77   | 8·24   | 2·97   | 2·98   | 3·10   | 2·50   | 49·51  |
| No. of           |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Rainy Days       | 14     | 14     | 15     | 13     | 16     | 13     | 12     | 12     | 12     | 13     | 13     | 13     | 160    |
| Evaporatn.       | 5·30   | 4·22   | 3·60   | 2·49   | 1·58   | 1·26   | 1·20   | 1·50   | 2·30   | 3·81   | 4·08   | 5·28   | 37·42  |

Among the more interesting extremes it may be noted that the maximum shade temperature exceeded 100° in each of the five months November to March, reaching the highest point on January 13th, 1896, when 103°·5 was registered. In no month of the year did the maximum fail to reach 70°, the lowest extreme being 74°·7 in June. The lowest minima recorded varied from 51°·2 in January to 35°·9 in July, the mid-winter month, showing that frost in the screen has been unknown in Sydney during the last half-century. The thermometer exposed to terrestrial radiation, however, fell below freezing point on some occasion during each month from May

to September inclusive, the absolute minimum being as low as  $24^{\circ}0$  on July 4th, 1893. Unfortunately details as to the number of ground frosts recorded are omitted, although their occurrence, even at rare intervals, must form an important feature in a sub-tropical climate.

Turning to the extremes of relative humidity it is instructive to remark that on no day in the whole period did this exceed 90 per cent. at 9 a.m., and from September to June never reached 80 per cent., a marked contrast to the climate of London, where complete saturation of the atmosphere is of comparatively frequent occurrence. On the other hand, the amount of moisture never fell so low as in the arid districts of the interior of Australia, the minimum at 9 a.m. being above 60 per cent. in eight months of the year, and never less than 55 per cent.

Some of the most remarkable of the figures quoted are undoubtedly the extremes of rainfall. Although the annual total is on the average less than 50 inches and the number of rainy days as many as 160,\* eight months of the year, chiefly in autumn and winter, show daily maxima exceeding 5.00 in. February, April and May had each falls of more than 7.00 in. in 24 hours, the greatest being 8.90 in. on February 25th, 1873.

The monthly means fall into a well-marked seasonal curve, reaching a maximum in April, corresponding to the October maximum of the north temperate zone, and a relatively dry season during the second half of the year, or spring and early summer. Every month, except December, is liable to a fall of 10 inches and April and May have exceeded 20 inches. The driest months in each instance had less than .50 in., but there was no absolutely rainless month.

No information is given as to the instruments employed in arriving at the average amounts of evaporation, but if these can be relied upon, considerably more than two-thirds of the annual rainfall is returned to the atmosphere in this direct manner.

## THE CYCLONIC DISTRIBUTION OF RAINFALL,

MR. J. A. UDDEN has published a paper† bearing on the methods of studying the distribution of weather conditions in cyclones, a full abstract of which may prove interesting. The work was suggested by a lecture delivered by a "Weather Bureau man," who "especially emphasized a statement we often find in text-books, that the greatest precipitation occurs in the region which lies some distance to the

\* It may be noted that the number of rainy days is the same as in London, while the amount of rainfall is twice as great, so that the average fall of rain per day in Sydney is twice as great as in London.

† "On the Cyclonic Distribution of Rainfall." By Johan August Udden. Published by Authority of the Board of Directors of Augustana College and Theological Seminary, Rock Island, Ill. 1903. Size  $10\frac{1}{4} \times 8$ . Pp. 22.



south-east of an area of low pressure," and by the remark of an observer of the weather at Davenport, Ill., who observed that the Weather Bureau forecasts usually came true, but that the predicted storms were apt to be a little behind time. Mr. Udden thought that there might be some connection between the two statements and resolved to determine by some statistical method the actual relation of weather conditions to different parts of a cyclone for his locality.

He accordingly made a diagram, reproduced in fig. 1, which represented a circular cyclone 2000 miles in diameter. The inner circle

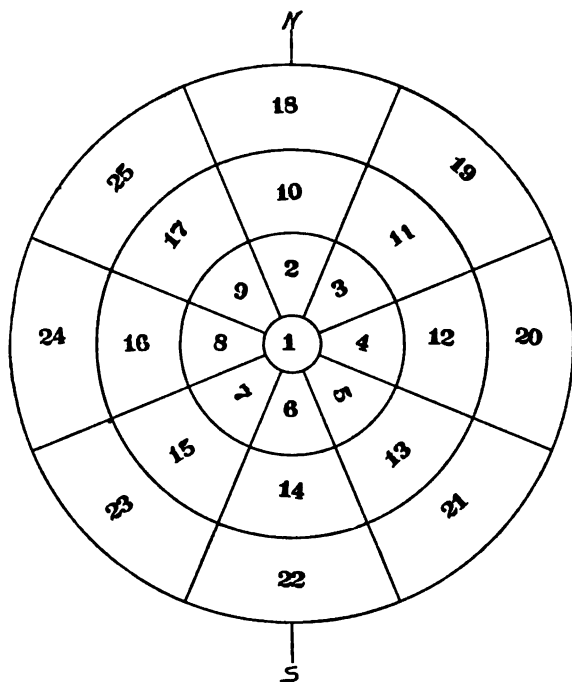


FIG. 1.

has a radius representing 100 miles, and the succeeding circles have radii each 300 miles longer than the one before. The circles are divided by eight radii and the resulting compartments numbered from 1 to 25, as shown. His method was then simply to take a sufficient number of observations of the weather at Davenport when that station lay in any one of the 25 corresponding tracts of an actual cyclone and to average these for each tract separately and thus obtain for each separate percentages expressing frequency of certain

weather conditions—precipitation, cloudiness and resultant wind direction being the three to which special attention was directed.

The observations at Davenport were made at 8 a.m. during about five years, the data being taken from the daily weather maps. About 1000 observations resulted, distributed somewhat unequally throughout the 25 tracts, but enough to secure a fairly representative average. "In other words: the number of times precipitation occurred or cloudiness prevailed was noted when Davenport was located in any one of the designated tracts with reference to the centre of a low area, and also the total number of times the opposite conditions prevailed. From these two figures percentages were obtained showing the comparative frequency of precipitation or cloudiness in each tract."

The result of this study was to show that at Davenport precipitation is most frequent when the station lies in tract No. 8, and relatively least frequent in the tracts to the south-east of the centre. Hence Mr. Udden points out that if precipitation is predicted on the assumption that the maximum frequency lies to the south-east of the centre a considerable number of hours will usually elapse before the wettest part of the cyclone, lying west of the centre, passes over

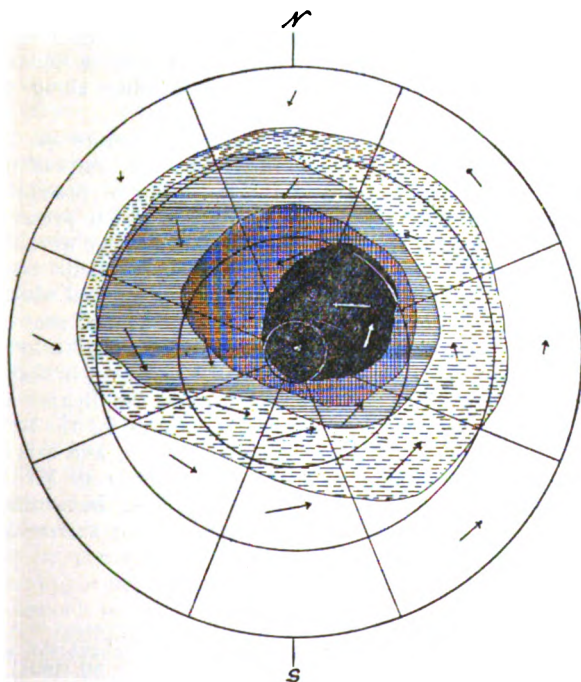


FIG. 2.

the place and thus the postponement of the prediction is accounted for.

Enlisting the aid of his students, Mr. Udden proceeded to make similar studies of other localities, representative of four different climatic regions of the United States, but in these he combined results from different stations—viz., Amarillo, Dodge City, Wichita, and Oklahoma, during 1894—98, to represent the south-western plains; Helena, Miles City, Leander and Boise City, for 1899; nine stations in the Upper Missouri Valley, for 1899; and finally Detroit and Buffalo for the years 1900—1903. The result was to “show clearly that the area of the greatest rain and snowfall is not in the same position with regard to the centres of low areas in different climatic regions. In every case it is eccentric and lies to the west, north-west, north or north-east, in the cases studied, but in no instance to the south-east.” We reproduce in fig. 2 the diagram of the distribution of precipitation and wind direction in a composite cyclone, based on the 8 a.m. observations at Detroit and Buffalo, where the heaviest precipitation lay in tract 3.

Mr. Udden indicates several lines of future research suggested by his first results, although the purpose of his paper was merely to call attention to the method of averaging. He suggests that diagrams for different hours of the day might show different results, that summer and winter cyclones are unlike, “and it is believed that there are differences among the cyclones coming along different paths.”

The above is a full abstract of the paper before us. Several points are left obscure. We are not told what limits of intensity were adopted in the estimation of the frequency of precipitation or cloud, nor is it stated whether only cyclones which preserved the cyclonic form of isobars for 1000 miles from the centre were included, or whether smaller cyclones merging into anticyclonic areas were also taken into account. The last suggestion quoted above as to differences in the direction of the path producing different effects is probably of high importance. The study of the distribution of rain in individual cyclones, by Dr. H. R. Mill,\* has shown that in the majority of rain-bringing cyclones which cross the British Isles, by far the greatest amount of precipitation occurs on the left of the track in whatever direction the cyclone is moving; and this suggests that it might be expedient to number the tracts in Mr. Udden's plan, not with relation to the cardinal points, but rather with reference to the diameter which lies in the line of the track of the centre.

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\* “On the Unsymmetrical Distribution of Rainfall about the path of a Barometric Depression,” *Symons's Meteorological Magazine*, 39 (1904), 161—165, and in *Report of Eighth International Geographic Congress*, 1904. Washington, 1905. Pp. 393—396.

## REVIEWS.

*Lehrbuch der Meteorologie* von DR. JULIUS HANN. *Zweite, neubearbeitete Auflage.* Leipzig: 1906, C. H. Tauchnitz. Size  $10\frac{1}{2} \times 7\frac{1}{2}$ , Pp. xii. + 644. Plates. Price 24 Marks.

PROFESSOR HANN's hunger for hard work has urged him to prepare a new and completely revised edition of his great text book of Meteorology, in which he brings the volume to date and improves it in every part. Much has been done by meteorologists in the five years which separate the second edition from the first, and the greatest tribute to the author's genius which any critic can offer is to point out that while nothing of real importance has been omitted, the new edition is 160 pages shorter than the old. This is brought about by a reduction of the very voluminous references to the older literature of the subject given in the first edition, and by a general compression of the subject matter, which was not possible when the book was being assembled out of the scattered constituent parts. We may look on the new *Lehrbuch* as the completed scheme towards which the author was working, freed from the scaffolding naturally required in putting the facts together for the first time.

Special attention is given to the results obtained by the investigations of the upper atmosphere, which form so important a feature of recent meteorological work. Amongst the additions and improvements we may also note a table of the mean monthly and annual temperatures at 143 places in all parts of the Earth, a shorter table of mean monthly and yearly rainfall at selected places, together with hygrometric and barometric tables. We have noticed several trifling typographical errors which have escaped mention in the table of errata, but most of these are of a kind which should have been put right by the printer's reader and do not reflect on the keenness of the author or his scrupulous exactitude in matters of scientific fact.

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*The Meteorology of the Ben Nevis Observatories. Part III., containing the Observations for the years 1893, 1894, 1895, 1896 and 1897, with Appendix.* Edited by ALEXANDER BUCHAN, LL.D., F.R.S., and ROBERT TRAILL OMOND. *Forming Volume XLIII. of the Transactions of the Royal Society of Edinburgh.* Edinburgh: 1905. Size  $12 \times 9\frac{1}{2}$ . Pp. 566.

THIS substantial volume contains the hourly readings of the meteorological instruments at the summit and low-level Ben Nevis Observatories for the five years 1893—97. In addition to the Tables, which occupy some 500 pages, there are two memoirs: the first, by Dr. Buchan, on the interrelation of barometric pressure, temperature, humidity, rainfall, cloud, sunshine, and wind, illustrated by the observations made at the two Observatories; and the second, by Dr. A. J. Herbertson, a report on hygrometric researches mainly at the Ben Nevis Observatories.

## TEMPERATURE FOR FEBRUARY, 1906.

| STATION.                         | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |          |      |        | No. of Nights<br>at or below 32° |        |
|----------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|----------|------|--------|----------------------------------|--------|
|                                  |                      |            |                      |                                | Max.         |          | Min. |        | Shade.                           | Grass. |
|                                  |                      |            |                      |                                | °            | Date.    | °    | Date.  |                                  |        |
| Camden Square.....               | London.....          | 51 32      | 0 8                  | 111                            | 51·1         | 24       | 26·1 | 22     | 14                               | 21     |
| Tenterden.....                   | Kent.....            | 51 4       | 0 41                 | 190                            | 50·5         | 18       | 27·0 | 22     | 11                               | 17     |
| Hartley Wintney.....             | Hampshire.....       | 51 18      | 0 53                 | 222                            | 49·0         | 25       | 23·0 | 6, 22  | 17                               | 21     |
| Hitchin.....                     | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | 47·0         | 10       | 25·0 | 5      | 19                               | ...    |
| Winslow (Addington).....         | Buckinghamsh. ....   | 51 58      | 0 53                 | 309                            | 49·0         | 25       | 19·0 | 6      | 17                               | 25     |
| Bury St. Edmunds (Westley) ..    | Suffolk.....         | 52 15      | 0 40                 | 226                            | 51·0         | 25       | 26·0 | 9      | ...                              | ...    |
| Brundall.....                    | Norfolk.....         | 52 37      | 1 26                 | 66                             | ...          | ...      | ...  | ...    | ...                              | ...    |
| Alderbury.....                   | Wiltshire.....       | 51 2       | 1 44                 | 263                            | 50·0         | 1, 21    | 20·0 | 5      | 18                               | ...    |
| Winterbourne Steepleton.....     | Dorset.....          | 50 42      | 2 31                 | 316                            | 48·8         | 26       | 20·0 | 6      | 13                               | 18     |
| Torquay (Cary Green).....        | Devon.....           | 50 28      | 3 32                 | 12                             | 51·5         | 20       | 29·6 | 6      | 3                                | 22     |
| Polapit Tamar [Launceston] ..    | ".....               | 50 40      | 4 22                 | 315                            | 49·4         | 18       | 25·6 | 6      | 9                                | 13     |
| Bath.....                        | Somerset.....        | 51 23      | 2 21                 | 67                             | 50·5         | 10       | 22·0 | 6      | 14                               | ...    |
| Stroud (Upfield).....            | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 48·0         | 1, 26    | 25·0 | 5      | 15                               | ...    |
| Church Stretton (Wooltaston) ..  | Shropshire.....      | 52 35      | 2 48                 | 800                            | 48·0         | 23       | 24·0 | 9 †    | 25                               | ...    |
| Bromsgrove (Stoke Newington) ..  | Worcestershire.....  | 52 19      | 2 4                  | 225                            | 45·0         | 25       | 21·0 | 5      | 21                               | ...    |
| Boston.....                      | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 45·0         | 10       | 25·0 | 6      | 17                               | ...    |
| Workshop (Hodsock Priory).....   | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 51·6         | 26       | 24·5 | 6      | 19                               | 26     |
| Derby (Midland Railway).....     | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 49·0         | 26       | 22·0 | 6      | 18                               | ...    |
| Bolton (Queen's Park).....       | Lancashire.....      | 53 35      | 2 28                 | 390                            | 47·6         | 7        | 27·1 | 5      | 14                               | 26     |
| Wetherby (Ribston Hall).....     | Yorkshire, W.R. .... | 53 59      | 1 24                 | 130                            | ...          | ...      | ...  | ...    | ...                              | ...    |
| Arncliffe Vicarage.....          | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...      | ...  | ...    | ...                              | ...    |
| Hull (Pearson Park).....         | " E.R. ....          | 53 45      | 0 20                 | 6                              | 48·0         | 1        | 26·0 | 18     | 18                               | 26     |
| Newcastle (Town Moor).....       | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...      | ...  | ...    | ...                              | ...    |
| Borrowdale (Seathwaite).....     | Cumberland.....      | 54 30      | 3 10                 | 423                            | 45·1         | 9        | 24·0 | 5      | 15                               | ...    |
| Cardiff (Ely).....               | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...      | ...  | ...    | ...                              | ...    |
| Haverfordwest (High Street) ..   | Pembroke.....        | 51 48      | 4 58                 | 95                             | 49·0         | 8        | 26·4 | 18     | 11                               | 20     |
| Aberystwyth (Gogerddan).....     | Cardigan.....        | 52 26      | 4 1                  | 83                             | 50·0         | 8 †      | 21·0 | 4      | 15                               | ...    |
| Llandudno.....                   | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 49·2         | 25       | 31·0 | 18     | 2                                | ...    |
| Cargen [Dumfries].....           | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 47·0         | 1, 6, 7  | 22·0 | 25     | 17                               | ...    |
| Lilliesleaf (Riddell House)..... | Roxburgh.....        | 55 31      | 2 46                 | 550                            | 47·0         | 19       | 22·0 | 4, 12  | 23                               | 27     |
| Edinburgh (Royal Observatory) .. | Midlothian.....      | 55 55      | 3 11                 | 442                            | 48·3         | 1        | 25·3 | 9      | 17                               | 22     |
| Colmonell (Clachanton).....      | Ayr.....             | 55 8       | 4 54                 | 140                            | 47·0         | 21, 22   | 21·0 | 4      | 12                               | ...    |
| Glasgow (Queen's Park).....      | Renfrew.....         | 55 53      | 4 18                 | 144                            | 46·0         | 1        | 20·0 | 11     | 20                               | 27     |
| Tighnabruich.....                | Argyll.....          | 55 55      | 5 14                 | 50                             | 42·0         | 1        | 24·0 | 23     | 24                               | 26     |
| Mull (Quinish).....              | ".....               | 56 36      | 6 13                 | 35                             | 45·0         | 1        | ...  | ...    | ...                              | ...    |
| Dundee (Eastern Necropolis) ..   | Forfar.....          | 56 28      | 2 57                 | 199                            | 47·3         | 6        | 23·4 | 5      | 20                               | ...    |
| Braemar.....                     | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...      | ...  | ...    | ...                              | ...    |
| Aberdeen (Cranford).....         | ".....               | 57 8       | 2 7                  | 120                            | 48·0         | 1        | 20·0 | 9      | 26                               | ...    |
| Cawdor (Budgate).....            | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...      | ...  | ...    | ...                              | ...    |
| Invergarry.....                  | E. Inverness.....    | 57 4       | 4 47                 | 130 †                          | ...          | ...      | ...  | ...    | ...                              | ...    |
| Loch Torridon (Bendampth).....   | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...      | ...  | ...    | ...                              | ...    |
| Dunrobin Castle.....             | Sutherland.....      | 57 59      | 3 56                 | 14                             | 47·0         | 18       | 24·0 | 9      | 22                               | ...    |
| Castletown.....                  | Caitness.....        | 58 35      | 3 23                 | 100                            | 46·0         | 21       | 17·0 | 10     | 21                               | 25     |
| Killarney (District Asylum) ..   | Kerry.....           | 52 4       | 9 31                 | 178                            | 52·5         | 21       | 30·0 | 18     | ...                              | ...    |
| Waterford (Brook Lodge).....     | Waterford.....       | 52 15      | 7 7                  | 104                            | 50·0         | 2, 26    | 24·0 | 5, 14  | 15                               | ...    |
| Broadford (Hurdlestown).....     | Clare.....           | 52 48      | 8 38                 | 167                            | 44·0         | var.     | 23·0 | 10, 11 | 13                               | ...    |
| Carlow (Browne's Hill).....      | Carlow.....          | 52 50      | 6 53                 | 291                            | ...          | ...      | ...  | ...    | ...                              | ...    |
| Dublin (Fitz William Square) ..  | Dublin.....          | 53 21      | 6 14                 | 54                             | 50·1         | 1        | 29·1 | 12     | 9                                | 20     |
| Ballinasloe.....                 | Galway.....          | 53 20      | 8 15                 | 160                            | 53·2         | 18, 24   | 21·0 | 21     | 20                               | ...    |
| Clifden (Kylmore House).....     | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...      | ...  | ...    | ...                              | ...    |
| Crossmolina (Enniscroe).....     | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...      | ...  | ...    | ...                              | ...    |
| Seaforde.....                    | Down.....            | 54 19      | 5 50                 | 180                            | 47·0         | 1, 9     | 27·0 | var.   | 19                               | 23     |
| Londonderry (Creggan Res.).....  | Londonderry.....     | 54 59      | 7 19                 | 320                            | ...          | ...      | ...  | ...    | ...                              | ...    |
| Omagh (Edenfel).....             | Tyrone.....          | 54 36      | 7 18                 | 280                            | 46·0         | 1, 7, 28 | 27·0 | 13, 20 | 17                               | 24     |

† and 16, 25. ‡ and 10, 11, 12

## RAINFALL FOR FEBRUARY, 1906.

| RAINFALL OF MONTH. |       |                    |          |                   |             | RAINFALL FROM JAN. 1. |       |                      |          | Mean Annual 1870-1899. | STATION.            |
|--------------------|-------|--------------------|----------|-------------------|-------------|-----------------------|-------|----------------------|----------|------------------------|---------------------|
| Aver. 1870-99.     | 1906. | Diff. from Av. in. | % of Av. | Max. in 24 hours. | No. of Days | Aver. 1870-99.        | 1906. | Diff. from Aver. in. | % of Av. |                        |                     |
| in.                | in.   |                    |          | in. Date.         |             | in.                   | in.   |                      |          | in.                    |                     |
| 1.62               | 1.89  | + .27              | 117      | .37 17            | 21          | 3.51                  | 5.91  | +2.40                | 168      | 25.16                  | Camden Square       |
| 1.85               | 2.22  | + .37              | 120      | .38 17            | 17          | 4.21                  | 5.86  | +1.65                | 139      | 28.36                  | Tenterden           |
| 2.06               | 1.95  | - .11              | 95       | .43 17            | 20          | 4.45                  | 6.29  | +1.84                | 141      | 27.10                  | Hartley Wintney     |
| 1.54               | 1.63  | + .09              | 106      | .31 16            | 18          | 3.35                  | 5.17  | +1.82                | 154      | 24.66                  | Hitchin             |
| 1.73               | 1.85  | + .12              | 107      | .25 16            | 19          | 3.78                  | 5.52  | +1.74                | 146      | 26.75                  | Addington           |
| 1.55               | 2.39  | + .84              | 154      | .43 19            | 21          | 3.25                  | 6.03  | +2.78                | 185      | 25.39                  | Westley             |
| 1.49               | 2.58  | +1.09              | 173      | .45 16            | 21          | 3.16                  | 6.52  | +3.36                | 206      | 25.40                  | Brundall            |
| 2.21               | 2.78  | + .57              | 126      | .40 16, 22        | 17          | 4.88                  | 8.43  | +3.55                | 173      | 29.17                  | Alderbury           |
| 3.11               | 4.18  | +1.07              | 134      | .75 22            | 22          | 7.01                  | 13.09 | +6.08                | 187      | 39.00                  | Winterbourne Stpltn |
| 2.87               | 3.81  | + .94              | 133      | .90 22            | 19          | 6.06                  | 10.02 | +3.96                | 165      | 35.00                  | Torquay             |
| 2.84               | 5.34  | +2.50              | 188      | .78 16            | 25          | 6.71                  | 12.80 | +6.09                | 191      | 38.85                  | Polapit Tamar       |
| 2.12               | 2.09  | - .03              | 99       | .57 22            | 20          | 4.64                  | 6.35  | +1.71                | 137      | 30.75                  | Bath                |
| 2.13               | 1.81  | - .32              | 85       | .24 16            | 18          | 4.59                  | 6.52  | +1.93                | 142      | 29.85                  | Stroud              |
| 2.27               | 2.65  | + .38              | 117      | .35 8             | 18          | 5.08                  | 6.81  | +1.73                | 134      | 33.04                  | Woolstaston         |
| 1.63               | 1.51  | - .12              | 93       | .30 8             | 12          | 3.54                  | 5.05  | +1.51                | 143      | 24.50                  | Bromsgrove          |
| 1.55               | 2.46  | + .91              | 159      | .45 27            | 14          | 3.14                  | 4.90  | +1.76                | 156      | 23.30                  | Boston              |
| 1.58               | 1.96  | + .38              | 124      | 1.00 27           | 19          | 3.32                  | 4.87  | +1.55                | 147      | 24.70                  | Hodssock Priory     |
| 1.66               | 2.57  | + .91              | 155      | .82 27            | 20          | 3.61                  | 5.85  | +2.24                | 162      | 26.18                  | Derby               |
| 2.67               | 4.52  | +1.85              | 169      | .63 10            | 22          | 6.05                  | 10.99 | +4.94                | 182      | 42.43                  | Bolton              |
| 1.63               | 2.05  | + .42              | 126      | .45 27            | 20          | 3.52                  | 6.00  | +2.48                | 171      | 26.96                  | Ribston Hall        |
| 4.74               | 5.69  | + .95              | 120      | .79 10            | 18          | 11.07                 | 15.65 | +4.58                | 141      | 60.96                  | Arnccliffe Vic.     |
| 1.86               | 1.71  | - .15              | 92       | .52 27            | 16          | 3.66                  | 4.21  | + .55                | 115      | 27.02                  | Hull                |
| 1.58               | 1.05  | - .53              | 66       | .38 19            | 16          | 3.54                  | 3.47  | - .07                | 98       | 27.99                  | Newcastle           |
| 11.64              | 9.34  | -2.30              | 80       | 1.61 9            | 16          | 26.35                 | 29.27 | +2.92                | 111      | 132.68                 | Seathwaite          |
| 3.13               | 4.12  | + .99              | 132      | .66 16            | 24          | 6.98                  | 11.69 | +4.71                | 167      | 42.81                  | Cardiff             |
| 3.70               | 4.06  | + .36              | 110      | .71 22            | 22          | 8.83                  | 11.40 | +2.57                | 129      | 47.88                  | Hayesfordwest       |
| 3.03               | 4.14  | +1.11              | 137      | .50 9             | 22          | 6.90                  | 11.39 | +4.49                | 165      | 45.41                  | Gogerddan           |
| 1.97               | 2.94  | + .97              | 149      | .47 9             | 18          | 4.54                  | 6.82  | +2.28                | 150      | 30.98                  | Llandudno           |
| 3.62               | 2.53  | -1.09              | 70       | .50 15            | 11          | 8.16                  | 7.37  | - .79                | 90       | 43.43                  | Cargen              |
| 2.41               | 1.44  | - .97              | 60       | .30 25            | 14          | 5.01                  | 4.42  | - .59                | 88       | 33.04                  | Riddell House       |
| ...                | 1.01  | ...                | ...      | .26 19            | 12          | ...                   | 4.12  | ...                  | ...      | ...                    | Edinburgh           |
| 3.67               | 2.83  | - .84              | 77       | .44 24            | 17          | 8.19                  | 7.73  | - .46                | 94       | 44.85                  | Colmonell           |
| 2.53               | 2.84  | + .31              | 112      | .48 24            | 18          | 5.78                  | 7.61  | +1.83                | 132      | 35.80                  | Glasgow             |
| 4.57               | 6.19  | +1.62              | 135      | .69 16            | 19          | 10.43                 | 13.39 | +2.96                | 128      | 57.90                  | Tighnabruaich       |
| 4.50               | 4.65  | + .15              | 103      | .85 24            | 21          | 10.35                 | 11.46 | +1.11                | 111      | 57.53                  | Quiniah             |
| 2.10               | .70   | -1.40              | 33       | .25 24            | 13          | 4.20                  | 2.75  | -1.45                | 66       | 28.95                  | Dundee              |
| 2.70               | 2.87  | + .17              | 106      | ...               | ...         | 5.61                  | 6.50  | + .89                | 116      | 36.07                  | Braemar             |
| 2.43               | 2.52  | + .09              | 104      | .55 24            | 20          | 4.75                  | 4.09  | - .66                | 86       | 33.01                  | Aberdeen            |
| 1.86               | 2.18  | + .32              | 117      | .45 8             | 16          | 4.00                  | 4.94  | + .94                | 124      | 29.37                  | Cawdor              |
| 4.89               | 2.22  | -2.67              | 46       | .41 25            | 8           | 11.52                 | 14.95 | +3.43                | 130      | 56.00                  | Invergarry          |
| 6.77               | 6.50  | - .27              | 96       | .88 25            | 25          | 15.52                 | 21.20 | +5.68                | 137      | 86.50                  | Bendamp             |
| 2.39               | 5.81  | +3.42              | 243      | 1.62 25           | 16          | 5.01                  | 8.68  | +3.67                | 173      | 31.60                  | Dunrobin Castle     |
| ...                | 6.49  | ...                | ...      | 1.84 10           | 25          | ...                   | 9.24  | ...                  | ...      | ...                    | Castletown          |
| 5.44               | 4.64  | - .80              | 85       | .61 12            | 27          | 12.01                 | 11.00 | -1.01                | 92       | 58.11                  | Killarney           |
| 3.30               | 3.69  | + .39              | 112      | 1.48 22           | 17          | 7.36                  | 8.55  | +1.19                | 116      | 39.30                  | Waterford           |
| 2.19               | 2.87  | + .68              | 131      | .38 12            | 25          | 5.17                  | 8.23  | +3.06                | 159      | 33.47                  | Hurdistown          |
| 2.61               | 2.62  | + .01              | 100      | .61 18            | 19          | 5.76                  | 6.48  | + .72                | 113      | 34.44                  | Carlow              |
| 1.98               | 1.64  | - .34              | 83       | .38 22            | 20          | 4.14                  | 5.77  | +1.63                | 139      | 27.75                  | Dublin              |
| 2.48               | 3.04  | + .56              | 123      | .63 9             | 24          | 5.97                  | 8.74  | +2.77                | 146      | 37.04                  | Ballinasloe         |
| 6.08               | 6.05  | - .03              | 100      | .75 9, 24         | 23          | 13.94                 | 17.13 | +3.19                | 123      | 80.23                  | Kylmore House       |
| 4.01               | 4.84  | + .83              | 121      | .52 15            | 25          | 9.01                  | 11.92 | +2.91                | 132      | 50.50                  | Enniscroe           |
| 2.97               | 2.05  | - .92              | 69       | .39 19            | 19          | 6.60                  | 6.02  | - .58                | 91       | 38.61                  | Seaforde            |
| 2.73               | 3.94  | +1.21              | 144      | .48 2             | 27          | 6.29                  | 9.71  | +3.42                | 154      | 41.20                  | Londonderry         |
| 2.49               | 3.00  | + .51              | 120      | .40 2             | 20          | 5.83                  | 8.34  | +2.51                | 143      | 37.85                  | Omagh               |

## SUPPLEMENTARY RAINFALL, FEBRUARY, 1906.

| Div.  | STATION.                          | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | 2.39            | XI.    | Rhayader, Tyrmynydd .....         | 7.00            |
| "     | Ramsgate, West Cliff Villas ..... | 1.57            | "      | Lake Vyrnwy .....                 | 6.51            |
| "     | Hailsham .....                    | 3.06            | "      | Llangyhanfal, Pîas Draw .....     | 2.53            |
| "     | Crowborough, Uckfield Lodge ..... | 3.26            | "      | Criccieth, Talarvor .....         | 4.10            |
| "     | Osborne, Newbarn Cottage .....    | 3.66            | "      | Llanberis, Pen-y-pass .....       | 14.28           |
| "     | Emsworth, Redlands .....          | 3.10            | "      | Lligwy .....                      | 3.36            |
| "     | Alton, Ashdell .....              | 3.11            | "      | Douglas, Woodville .....          | 3.75            |
| "     | Newbury, Welford Park .....       | 2.55            | XII.   | Stoneykirk, Ardwell House .....   | 1.56            |
| III.  | Harrow Weald, Hill House .....    | 2.10            | "      | Dalry, The Old Garroch .....      | 4.97            |
| "     | Oxford, Magdalen College .....    | 1.35            | "      | Langholm, Drove Road .....        | 3.84            |
| "     | Bloxham Grove .....               | 1.81            | "      | Moniaive, Maxwellton House .....  | 3.47            |
| "     | Pitaford, Sedgebrook .....        | 2.22            | XIII.  | N. Esk Reservoir [Penicuik] ..... | 2.35            |
| "     | Huntingdon, Brampton .....        | 1.71            | XIV.   | Maybole, Knockdon Farm .....      | 2.56            |
| "     | Wisbech, Bank House .....         | 1.98            | "      | Campbeltown, Witchburn .....      | 3.94            |
| IV.   | Southend Water Works .....        | 1.42            | XV.    | Inveraray, Newtown .....          | 5.70            |
| "     | Colchester, Lexden .....          | 1.93            | "      | Ballachulish House .....          | 6.52            |
| "     | Newport, The Vicarage .....       | 2.10            | "      | Islay, Eallabus .....             | 5.65            |
| "     | Rendlesham .....                  | 1.96            | XVI.   | Dollar Academy .....              | 2.76            |
| "     | Swaffham .....                    | 2.35            | "      | Loch Leven Sluice .....           | 2.11            |
| "     | Blakeney .....                    | 1.91            | "      | Balquhider, Stronvar .....        | 4.03            |
| V.    | Bishops Cannings .....            | 2.75            | "      | Perth, Pitcullen House .....      | 1.44            |
| "     | Ashburton, Druid House .....      | 5.88            | "      | Coupar Angus Station .....        | 1.24            |
| "     | Okehampton, Oaklands .....        | 5.43            | "      | Blair Atholl .....                | 3.31            |
| "     | Hartland Abbey .....              | 4.71            | "      | Montrose, Sunnyside Asylum .....  | 1.12            |
| "     | Lynmouth, Rook House .....        | 4.48            | XVII.  | Alford, Lynturk Manse .....       | 2.31            |
| "     | Probus, Lamellyn .....            | 5.44            | "      | Keith Station .....               | 2.41            |
| "     | Wellington, The Avenue .....      | 2.82            | XVIII. | N. Uist, Lochmaddy .....          | 3.56            |
| "     | North Cadbury Rectory .....       | 2.70            | "      | Alvey Manse .....                 | 1.92            |
| VI.   | Clifton, Pembroke Road .....      | 2.53            | "      | Loch Ness, Drumnadrochit .....    | 3.42            |
| "     | Moreton-in-Marsh, Longboro' ..... | 2.25            | "      | Glen carron Lodge .....           | 6.36            |
| "     | Ross, The Graig .....             | 1.23            | "      | Fearn, Lower Pitkerrie .....      | 2.57            |
| "     | Shifnal, Hatton Grange .....      | 1.46            | XIX.   | Inverahin .....                   | 4.09            |
| "     | Cheadle, The Heath House .....    | 3.10            | "      | Altnaharra .....                  | 6.42            |
| "     | Coventry, Kingwood .....          | 2.64            | "      | Bettyhill .....                   | 5.39            |
| VII.  | Market Overton .....              | 1.80            | "      | Watten Station .....              | 4.17            |
| "     | Market Rasen .....                | 2.25            | XX.    | Dunmanway, The Rectory .....      | 5.28            |
| "     | Bawtry, Heeley Hall .....         | 2.01            | "      | Cork .....                        | 2.85            |
| VIII. | Neston, Hinderton .....           | 1.98            | "      | Darrynane Abbey .....             | 4.75            |
| "     | Southport, Hesket Park .....      | 3.26            | "      | Glenam [Clonmel] .....            | 3.41            |
| "     | Chatburn, Middlewood .....        | 3.22            | "      | Ballingarry, Gurteen .....        | 2.54            |
| "     | Cartmel, Flookburgh .....         | 2.78            | "      | Milltown Malbay .....             | 4.21            |
| IX.   | Langeatt Moor, Up. Midhope .....  | 4.27            | XXI.   | Gorey, Courtown House .....       | 2.58            |
| "     | Scarborough, Scalby .....         | 2.04            | "      | Moynalty, Westland .....          | 2.81            |
| "     | Ingleby Greenhow .....            | 2.18            | "      | Athlone, Twyford .....            | 2.84            |
| "     | Mickleton .....                   | 1.34            | "      | Mullingar, Belvedere .....        | 2.91            |
| X.    | Bardon Mill, Beltingham .....     | 1.30            | XXII.  | Woodlawn .....                    | 3.85            |
| "     | Ewesley, Fallowlee .....          | 1.19            | "      | Westport, Murriack Abbey .....    | 4.49            |
| "     | Ilderton, Lilburn Cottage .....   | .95             | "      | Collooney, Markree Obay .....     | 4.20            |
| "     | Keewick, York Bank .....          | 4.10            | XXIII. | Enniskillen, Portora .....        | 3.13            |
| XI.   | Llanfrecfa Grange .....           | 3.90            | "      | Warrenpoint, Summer Hill .....    | 2.21            |
| "     | Treherbert, Tyn-y-waun .....      | 7.29            | "      | Banbridge, Milltown .....         | 2.42            |
| "     | Carmarthen, The Friary .....      | 4.56            | "      | Belfast, Springfield .....        | 3.29            |
| "     | Castle Malgwyn [Llechryd] .....   | 4.20            | "      | Bushmills, Dundarave .....        | 2.62            |
| "     | Plylimon .....                    | 10.08           | "      | Stewartstown, The Square .....    | 2.78            |
| "     | Tall-y-llyn .....                 | 3.10            | "      | Killybegs .....                   | 6.21            |
| "     | New Radnor, Ednol .....           | 3.80            | "      | Horn Head .....                   | 4.31            |

## METEOROLOGICAL NOTES ON FEBRUARY, 1906.

**ABBREVIATIONS.**—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

**LONDON, CAMDEN SQUARE.**—Rainy and unpleasant conditions continued with little intermission until about 19th, but with considerably reduced temp.; the last week was, however, somewhat more genial. Mean temp.  $38^{\circ}7$ , or  $1^{\circ}1$  below the average and  $3^{\circ}2$  below the mean for January, 1906. Duration of sunshine  $67^{\circ}9$  hours and of S  $52^{\circ}2$  hours.

**CROWBOROUGH.**—R was  $\cdot 92$  in. above the average, making the excess for the year equal to the average for March and April together. Mean temp.  $37^{\circ}3$ , or  $0^{\circ}5$  below the average.

**HARTLEY WINTNEY.**—After the first week, which was dry, frost at night alternated with R during the day and strong N.W. and W. winds. Short, sharp TS with S, H and R on 8th. Mean amount of ozone 4.1.

**TORQUAY.**—Mean temp.  $41^{\circ}8$ , or  $1^{\circ}4$  below the average. Duration of sunshine  $121^{\circ}4$  hours, or  $39^{\circ}9$  hours above the average. Mean amount of ozone 5.4. The sunniest February since 1891.

**WELLINGTON.**—Stormy and colder than January with many small falls of S, but R only slightly above the normal.

**NORTH CADBURY.**—A cold, raw month and the windiest February in 10 years. Great duration of R, but a fall only slightly above the average.

**WORKSOP.**—Unsettled but sunny, with many frosts, low pressure, and mean temp.  $1^{\circ}5$  below the average. Duration of sunshine the greatest in 25 years except in 1887.

**BOLTON.**—Cold, wet and changeable, with mean temp.  $36^{\circ}5$ , or  $1^{\circ}1$  below the average. Duration of sunshine  $49^{\circ}7$  hours, or  $10^{\circ}3$  hours above the average. A blizzard, with strong W.S.W. wind, T and L, occurred on 8th, the mean depth of S being about 5 inches.

**SOUTHPORT.**—Exceptionally sunny, yet wet and stormy. Mean temp.  $38^{\circ}2$ , or  $0^{\circ}8$  below the average, the extreme range being the smallest on record in February. Duration of sunshine  $98^{\circ}4$  hours, or  $29^{\circ}8$  hours above the average, and of R  $72^{\circ}6$  hours.

**CARMARTHEN.**—Unusually wet, with cold winds, sleet and cold R. Agricultural labour was retarded by the wet weather.

**HAVEFORDWEST.**—Moderate R and unusually low day temp. not once reaching  $50^{\circ}$ . Duration of sunshine  $80^{\circ}3$  hours. Gales on five days.

**DOUGLAS.**—Quite a winter month, wet and stormy with temp. below the average throughout, but no great cold and an excess of bright sunshine.

**COUPAR ANGUS.**—Cold and stormy generally with several S storms. R  $\cdot 71$  in. below the average of 25 years. Mean temp.  $35^{\circ}1$ , or  $1^{\circ}4$  below the average.

**LYNTURK MANSE.**—S lay on the ground throughout, and roads were more blocked than usual, owing probably to the frequent changes of wind.

**DRUMNADROCHIT.**—The month was one prolonged S storm, but the temp. was fairly high and there were no very keen frosts. R  $\cdot 49$  in., and rainy days 2, above the average of 20 years.

**WATTEN.**—A series of gales, S and R storms, with some clear frosty days.

**DARBYNANE ABBEY.**—Constant R but no very heavy fall, the total being only  $4^{\circ}2$  per cent. above the average. About two inches of S on 11th.

**DUBLIN.**—Cold and changeable, with frequent but not heavy R, which often fell as H or sleet. Mean temp.  $39^{\circ}7$ ; low night temp., and max. reaching  $50^{\circ}$  on one day only.

**BELFAST.**—R above the average and of infinite service to the soil. S and frost were more prominent than usual.

**OMAGH.**—A raw, damp, and generally rainy month, but with no greater indication of winter than a few light night frosts and an occasional forenoon with the ground almost white with S.

\* Campbell-Stokes.



## Climatological Table for the British Empire, September, 1905.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain. |       | Aver. |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|-------------|-------|-------|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.      | Days. |       |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |      |               |           |                 |                   |             |       |       |
|                                                                  | °         |       | °        |       | °        |      | °             | 0-100     | °               | °                 | inches      |       | °     |
| London, Camden Square                                            | 76·5      | 3     | 42·7     | 15    | 65·9     | 50·1 | 51·0          | 83        | 118·7           | 36·6              | 2·09        | 12    | 6·0   |
| Malta.....                                                       | 92·1      | 26    | 65·3     | 22    | 85·6     | 71·5 | 68·6          | 75        | 141·8           | 61·7              | ·94         | 2     | 1·9   |
| Lagos.....                                                       | 86·0      | 9     | 71·0     | 2     | 83·0     | 74·0 | 72·0          | 78        | 144·0           | 62·5              | 1·54        | 13    | 7·2   |
| Cape Town .....                                                  | 80·7      | 17    | 44·0     | 16    | 65·0     | 52·1 | 50·4          | 75        | ...             | ...               | 1·59        | 7     | 5·8   |
| Durban, Natal .....                                              | 84·6      | 29    | 50·6     | 13    | 76·3     | 59·2 | ...           | ...       | 138·4           | ...               | 2·39        | 16    | 4·8   |
| Johannesburg .....                                               | 81·8      | 23    | 29·0     | 17    | 70·9     | 47·9 | 42·0          | 80        | 144·9           | 23·3              | ·22         | 4     | 2·6   |
| Mauritius.....                                                   | 81·2      | 21    | 53·2     | 2     | 79·1     | 62·4 | 62·2          | 76        | 145·8           | 42·7              | 2·00        | 12    | 5·9   |
| Calcutta.....                                                    | 93·0      | 19    | 74·6     | 29    | 88·3     | 78·2 | 77·5          | 85        | 166·2           | 73·1              | 11·20       | 18    | 7·7   |
| Bombay.....                                                      | 88·3      | 29    | 75·5     | 9     | 85·8     | 77·3 | 74·9          | 81        | 135·3           | 71·8              | 6·16        | 14    | 5·9   |
| Madras .....                                                     | 101·8     | 26    | 74·8     | 2     | 95·3     | 79·1 | 74·2          | 74        | 152·1           | 73·2              | 2·77        | 8     | 5·7   |
| Kodaikanal .....                                                 | 69·0      | 30    | 50·4     | 28    | 63·8     | 52·4 | 51·0          | 81        | 140·6           | 32·8              | 7·34        | 23    | 6·9   |
| Colombo, Ceylon.....                                             | 88·4      | 3     | 73·2     | 6     | 86·1     | 76·2 | 74·3          | 82        | 149·2           | 70·0              | 10·75       | 20    | 5·8   |
| Hongkong.....                                                    | 89·6      | 2     | 71·3     | 19    | 84·7     | 76·5 | 73·7          | 81        | 142·9           | ...               | 3·20        | 15    | 6·5   |
| Melbourne.....                                                   | 70·0      | 13    | 32·0     | 18    | 56·4     | 42·0 | 39·5          | 74        | 129·5           | 25·0              | 2·46        | 16    | 6·8   |
| Adelaide.....                                                    | 75·1      | 12    | 35·9     | 28    | 52·0     | 43·5 | 40·7          | 72        | 133·6           | 31·5              | 1·51        | 17    | 5·9   |
| Coolgardie .....                                                 | 74·2      | 15    | 36·0     | 5     | 65·6     | 42·9 | 40·0          | 57        | 149·0           | 30·4              | ·70         | 6     | 3·7   |
| Sydney .....                                                     | 75·3      | 4     | 41·0     | 7     | 64·4     | 47·3 | 40·3          | 62        | 122·3           | 30·1              | 2·50        | 12    | 3·5   |
| Wellington .....                                                 | 59·5      | 1     | 38·5     | 30    | 55·5     | 45·7 | 43·3          | 77        | 116·0           | 33·0              | 6·02        | 18    | 7·0   |
| Auckland .....                                                   | 63·0      | 5     | 43·0     | 6     | 59·8     | 48·3 | 48·2          | 80        | 126·0           | 37·0              | 4·48        | 25    | 6·0   |
| Jamaica, Negril Point.....                                       | 89·1      | 5     | 70·7     | 20    | 87·2     | 73·5 | 74·3          | 80        | ...             | ...               | 4·22        | 11    | ...   |
| Trinidad .....                                                   | 90·0      | sev.  | 68·0     | 12    | 87·2     | 71·1 | 73·1          | 84        | 170·0           | 64·0              | 10·43       | 17    | ...   |
| Grenada.....                                                     | 88·6      | 17    | 72·0     | 7     | 84·8     | 75·0 | 72·5          | 76        | 150·0           | ...               | 5·42        | 20    | 3·3   |
| Toronto .....                                                    | 83·2      | 30    | 31·9     | 26    | 71·5     | 53·1 | 55·6          | 79        | ...             | 26·0              | 1·73        | 12    | 4·9   |
| Fredericton .....                                                | 78·7      | 10a   | 29·5     | 15    | 63·8     | 45·5 | 46·7          | 64        | ...             | ...               | 5·25        | 13    | 6·1   |
| Winnipeg .....                                                   | 86·0      | 29    | 29·0     | 12    | 70·8     | 46·3 | ...           | ...       | ...             | ...               | 1·56        | 9     | 4·3   |
| Victoria, B.C. ....                                              | 75·0      | 1     | 44·4     | 29    | 61·5     | 51·2 | ...           | ...       | ...             | ...               | 4·03        | 15    | 7·4   |
| Dawson .....                                                     | 58·4      | 1     | 18·8     | 20    | 45·7     | 33·3 | ...           | ...       | ...             | ...               | 3·32        | 15    | 6·8   |

a and 11.

**MALTA.**—Mean temp. of air 77°·4, or 2°·4 above, mean hourly velocity of wind 7·1 miles, or 0·7 below, average. Mean temp. of sea 79°·7.

**MAURITIUS.**—Mean temp. of air 0°·5, dew point 2°·0, and E ·61 in. above averages. Mean hourly velocity of wind 7·6 miles, or 4·4 below average. Mean computed direction E.

**MADRAS.**—Bright sunshine 150·7 hours.

**KODAIKANAL.**—Bright sunshine 122 hours.

**HONGKONG.**—Mean temp. of air 80°·1. Mean direction of wind E., and mean hourly velocity 14·8 miles. Bright sunshine 199·5 hours.

**ADELAIDE.**—Mean temp. of air 5°·1 below average. The coldest September in 48 years' record. E ·21 in. below average.

**SYDNEY.**—Temp. of air 2°·9 below, humidity 7·6 below, and E ·46 in. below, averages.

**WELLINGTON.**—Mean temp. of air 1°·0 below, and E 1·50 in. above, averages.

**AUCKLAND.**—Mean temp. of air slightly below average, and E 1·00 in. above the previous 37 years' average.

# Symons's Meteorological Magazine.

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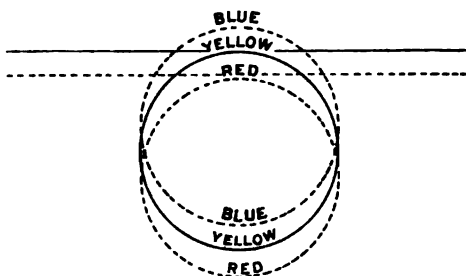
VOL. XLI.

## THE GREEN FLASH ON THE HORIZON.

BY ARTHUR A. RAMBAUT, D.Sc., F.R.S.

(Continued from p. 23.)

EVERY astronomer is familiar with the fact that in a telescope the image of a star observed near the horizon is drawn out into a short spectrum. In the case of an object with a measurable disk, such as the sun or a planet, this effect becomes exceedingly troublesome when accurate measurements are required, even while the object is at a considerable altitude. The images formed by the variously coloured rays are not exactly superposed but fall as is shown in the diagram, in which, for simplicity, only the alternate colours, red, yellow and blue are indicated. It is obvious that, as the sun sinks in the west, the red image will be the first to disappear, then the yellow; and at the moment when the horizon is in the position indicated by the continuous straight line in the figure, it is clear that only blue light can reach the eye. This way of representing the facts also explains why at sunset the tips are the first to become green (when the horizon cuts through the yellow disk as indicated by the dotted line in the diagram), as is generally found to be the case if the flash is well seen with the aid of glasses. In the *Memoirs of the Royal Astronomical Society*, Vol. xlv., p. 121, Sir David Gill draws attention to the effect of this inequality in the observations of Mars made at Ascension in 1877. The same effect was discussed by Airy, in the *Monthly Notices*, R.A.S., Vol. xxix., p. 333, when arranging for the observation of the Transit of Venus in 1874, and he proposed the use of a prism in the eyepiece of the telescope to correct the dispersion.



We have thus in the atmospheric dispersion of light a *vera causa* which must necessarily give rise to something in the nature of a green or blue flash. The only question is whether the dispersive effect is large enough to account for the flashes as actually seen. The following considerations will help us to come to a decision on this point.

Bouguer, in 1729, was the first to notice this atmospheric dispersion. Sir William Herschel, in 1785, and Stephen Lee, in 1815, tried to measure its amount. Robinson found that the image of Vega at its lower culmination at Armagh, when its altitude would have been about  $3^\circ$ , measured  $22''$  in a vertical direction. F. Struve found a similar extension of the image of Fomalhaut at its culmination above the horizon at Dorpat, and concluded that the atmospheric dispersion of the visible spectrum is about  $\frac{1}{100}$ th of the refraction. Airy estimates it at about  $\frac{1}{60}$ th of the refraction. If we consider any two rays, R and R', and if we denote the refractive index of the air for R by  $\mu$ , and that for R' by  $\mu'$ ; then if  $\beta$  denote the coefficient of refraction for R and  $\beta'$  that for R' we have approximately

$$(\beta' - \beta) / \beta = (\mu' - \mu) / (\mu - 1).$$

The difference  $\beta' - \beta$  is the coefficient of dispersion for the two rays. Thus we see that the ratio of the dispersion to the total refraction is given by the expression  $(\mu' - \mu) / (\mu - 1)$ .

If now we take R to be the ray represented by the Fraunhofer line C in the red portion of the solar spectrum, and R' to correspond to the line F in the green-blue, we have

$$\mu = 1.00029383 \text{ and } \mu' = 1.00029685,$$

from which we find that

$$\frac{\mu' - \mu}{\mu - 1} = \frac{302}{29383} = \frac{1}{98} \text{ approximately, thus}$$

agreeing very closely with Struve's estimate. On the other hand, if we had taken the Fraunhofer lines A, in the deep red, and G, in the deep blue, we should have found  $\frac{1}{50}$  as the value of this expression. The true value is probably somewhere between these two extremes, and we cannot be far wrong if we take it to be  $\frac{1}{72}$ .

At the moment when the last red rays of the sun disappear beneath the horizon they are bent through an angle of about  $36'$  by the refraction, the exact amount depending on the condition of the air; but if we adopt the value,  $\frac{1}{72}$ , for the ratio of the dispersion to the refraction, we see that the rays at the other end of the visible spectrum are at the horizon refracted through an angle greater by  $\frac{1}{72}$ nd part than this, i.e., through an angle of  $36'.5$ . They will accordingly not wholly disappear until the sun has sunk to this depth beneath the horizon. The absence of the red rays will give a preponderance to the green and blue, so that we should expect a change of tint, passing through green to blue, to last while the sun was passing from a depth of  $36'$  to  $36' 30''$  below the horizon. We have there-

fore to find the time occupied by the sun in passing through this angle of  $30''$ , and it is not difficult to show that this time will be shortest if the observer is situated on the equator at the time of either equinox, and will then be equal to 2 seconds. In other latitudes where the sun crosses the horizon obliquely it may last much longer, and in the neighbourhood of the Arctic Circle it is conceivable that at midsummer the sun might pass so close below the horizon at midnight that the red rays would be cut off while the green and blue remained visible, and accordingly a "green flash" be seen, for more than 12 minutes. Farther north, the duration might extend to even greater length. As seen from either pole a prolonged display might be seen about the time of the equinoxes, as the sun passes from one side of the equator to the other; but the rapid movement of the sun in declination at these dates complicates the calculation, and in view of the scarcity of observers in those parts it seems hardly worth while to go more elaborately into the question. The value of 2 seconds found for the minimum duration agrees very well with the actual facts, most observers estimating it from barely 2, to 3 or 4 seconds of time.

With regard to the very pertinent question put by Admiral McClear, in his letter which appeared in this Magazine for January, viz. : "Why should the flash be green?" I would remark that the term "green flash" is from many points of view an unsatisfactory description of the phenomenon. When best seen the colour of the remaining segment of the sun at setting turns, at the very last moment, from green to blue. Many writers have described it as a *blue* flash, not *green* (see the remarks of the late Mr. Cowper Ranyard in *Knowledge*, April, 1889, and Prof. W. H. Pickering's paper in the *Monthly Notices*, both included in the list of references on pp. 21 and 22). Many of the passengers on board the *Durham Castle* described the flash seen over Guardafui on September 27th as blue, and, as already stated, one of the observers of the rising sun, on September 29th, preferred to describe the colour of the very first ray as blue rather than green. The fact that the flash does not appear indigo or violet is accounted for partly by the relative feebleness with which these rays impress the eye compared with the yellow, green and blue rays, and partly by the selective absorption of the atmosphere which cuts down the rays of shorter wave length in a larger proportion than those that are less refrangible. The violet and indigo are thus most reduced.

Professor Michie Smith, in his letter referred to above, questions the adequacy of the refraction theory to account for all the facts. He says, "If the phenomenon were due simply to refraction it would last for only a fraction of a second and the colour would be much more blue than green," and then he calls in the aid of absorption by dust—"water dust or other"—to supplement the refraction. As an effect of this dust-absorption the sun has been seen in India and other places of a pea green colour while still many degrees above the

horizon, an effect which was particularly striking shortly after the great eruption of Krakatoa in 1883, when the Earth's atmosphere was charged with immense masses of finely divided volcanic dust. But, although the effect of dust may perhaps sometimes intensify the blueness, it is, as I have already shown, not necessary to have recourse to this, the atmospheric dispersion alone being sufficient to account for the duration of the flash. The phenomenon is most frequently seen over a sea horizon, while a steady atmosphere and a calm sea appear to be usually associated with its appearance, a state of affairs in which the amount of fine spray—or, to use Prof. Michie Smith's expressive phrase, "water dust," in suspension close to the surface of the sea is a minimum. In this connection the observations described by Mr. Whitmell in the *Journal* of the B.A.A., xii. 289, are to my mind conclusive. He writes, "In the belfry of the Wesleyan Chapel, on the west side of Woodhouse Moor, there are narrow horizontal openings, through which, at certain times, the setting sun can send his rays to an observer at the large band-stand, about 300 yards away. On Saturday, 26th April, between 7½ and 7¾ p.m., I was so exceptionally fortunate as to observe through the openings no fewer than three green and three red flashes. The red ones were seen just as the base of the sun successively revealed itself below each of the upper edges of three of the openings. The green ones were seen just as the top of the sun disappeared behind each of the lower edges of the openings." This is exactly what we should expect to see as the effect of the atmospheric dispersion of the light, but I find it impossible to conceive how *both* green and red flashes could be brought about by the absorption of dust.

These observations of Mr. Whitmell's suggested to me a method of seeing the green and red flashes any morning or evening when the sun is shining in a clear sky. For this purpose it is only necessary to place an opaque diaphragm in the focal plane of the objective of a telescope, so as to screen off one half of the field of view. The edge of the diaphragm should be very sharp and burnished, and should coincide with the diameter of the field. If the diaphragm is placed with its edge horizontal so as to obscure the lower half of the field of view, as projected on a white screen placed behind the eyepiece, then, as the sun sinks behind this artificial horizon line, the last narrow segment, corresponding to the highest point of the sun's limb, will become a vivid blue before disappearance. On the other hand, by rotating the diaphragm through 180° in its own plane so as to obscure the upper half of the field, and allowing the sun's image to emerge from behind it, the first segment, corresponding to the lowest point of the limb, will appear brilliantly red.

On the first occasion on which I had an opportunity of trying the experiment I did so, and though there was a thick haze near the horizon as the sun went down, I was able to exhibit these green and red flashes as often as I pleased. The observations were made

between 5 p.m. and 5.15 p.m., while the sun was sinking from an altitude of  $5^{\circ} 25'$  to one of  $3^{\circ} 12'$  above the horizon.

More recently I have had a diaphragm with a narrow diametral slit, about  $\frac{1}{40}$  of an inch wide, inserted in the focal plane of a small telescope of  $3\frac{1}{4}$  inches aperture. This slit takes the place of the openings in Mr. Whitmell's belfry, and the necessity for rotating the eyepiece is avoided. With this apparatus I have frequently shown the blue and red fringes at the top and bottom of the sun's disk. Unless the air is very unsteady the red fringe at the bottom is always conspicuous when the sun is low, but a haze near the horizon reduces the intensity of the blue-green fringe at the top. This will account for the fact that the "flash" is not more frequently seen in these latitudes. When the sky is free from haze the blue-green fringe is as striking as the red.

This is an observation by which any possessor of a telescope can easily satisfy himself that the flashes are due to atmospheric dispersion of light, and is at least less expensive than building a Wesleyan Chapel with horizontal openings in the belfry.

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#### SCOTTISH METEOROLOGICAL SOCIETY.

A MEETING of the Society was held at 5, St. Andrew Square, Edinburgh, on March 12th, at 2.30 p.m., the Hon. Lord McLaren, President of the Society, in the chair.

The report from the Council was adopted, sympathetic reference being made to the faithful services of the late Miss Jessie Hill Buchan.

Dr. J. Halm contributed a paper under the title "The Influence of Atmospheric Temperature Conditions on Astronomical Observations." Experiments by the late Professor Langley had shown that, contrary to the conventional opinion, the definition of telescopic images was much clearer when the air in the neighbourhood of the instrument was agitated than when it was in a state of tranquillity. It was impossible to experiment with the general mass of the atmosphere, but we could note the differences in clearness of definition corresponding to various weather conditions. The blurring of the images was due, of course, to the passage of the light rays through atmospheric layers having different indices of refraction. Thus on theoretical grounds we should expect astronomical seeing to be best when the air was violently stirred by strong convection currents, for it was then that the state of adiabatic equilibrium was most nearly approached in which any given mass of ascending air assumed the exact temperature and density of the masses it successively displaced. On the other hand, seeing should be worst on clear winter nights when terrestrial radiation was most active and a slow sinking movement of the atmosphere disturbed the refrangibility of the successive layers. Experience agreed with theory. Thus Dr. Halm had found during his work in the conti-

mental climate of Strasburg, where the diurnal temperature range was large, that the images were clearest towards sunset on early summer evenings. Gradually as nocturnal radiation became more and more active, the images became blurred. Definition was quite unsatisfactory by two o'clock in the morning and worst about sunrise.

The suggestion was made that climatic and topographic conditions should be taken into account in selecting sites for new astronomical observatories. The slopes or neighbourhood of mountains should afford favourable positions, since there horizontal air currents were deflected upwards, so that the surrounding atmosphere was more or less disturbed and the desirable state of indifferent equilibrium more frequently and readily attained.

Professor Knott made the interesting observation that Sir Isaac Newton in his "Optics" had suggested that mountain summits should be favourable positions for astronomical work on account of the stillness of the atmosphere there! Newton had never dreamt that good definition depended on the commotion of the atmosphere rather than on its tranquillity.

In a paper "On Large Differences of Temperature between Ben Nevis and Fort William," by Mr R. T. Omond, it was pointed out that the average difference of temperature between the two observatories was  $15^{\circ}5$  F. By far the greater number of the hourly differences were somewhere near this value, but there were a few extreme cases ranging from a maximum difference of  $28^{\circ}8$  at 2 a.m. on 19th December, 1890, to a minimum at 9 a.m. on February 19th, 1895, when the summit of the mountain was no less than  $17^{\circ}6$  *warm*er than the base (Ben Nevis,  $33^{\circ}6$ ; Fort William,  $16^{\circ}0$ ). During a period of thirteen and a-half years there had been only 205 hours at which there was a difference of at least  $25^{\circ}$ . Though the extreme case had occurred on a winter's night, almost all the cases of large differences had been on summer afternoons, invariably with dry air at Fort William and nearly always with strong winds. There had been only three occasions on which a temperature difference of  $25^{\circ}$  or over had continued for more than four consecutive hours. On the other hand, actual inversions of temperature might persist continuously for many hours, or even for two or three days, in succession. The adiabatic rate of change of temperature in the case of dry air corresponded to a temperature difference of about  $24^{\circ}$  in an air column 4,400 feet in height, and the rarity of differences larger than this appeared to indicate that the adiabatic limit was a definite controlling factor in fixing approximately an upper limit to the variations of the difference of temperature between the summit and base of the mountain. That when the adiabatic difference was exceeded the air column was in a state of instability was shown by the fact, already indicated, that the occurrence of very large differences had never been long continued.

Mr. Omond's paper was followed by an interesting discussion, in which Professor Knott, Dr. Halm, Dr. Buchan and Lord McLaren took part.

## METEOROLOGICAL OBSERVATIONS TAKEN DURING 1905 AT BANANI, PEMBA, NEAR ZANZIBAR.

WE are again indebted to Mr. T. P. Newman for particulars of the meteorological observations taken by Mr. Theodore Burt, of the Friends' Industrial Mission at Pemba.

| 1905.           | Mean<br>Max. | Mean<br>Min. | Absolute<br>Max. | Absolute<br>Min. | Rainfall. | Rain<br>Days |
|-----------------|--------------|--------------|------------------|------------------|-----------|--------------|
|                 |              |              |                  |                  | in.       |              |
| January .....   | 83.8         | 73.7         | 87.0             | 72.0             | .63       | 5            |
| February .....  | 83.8         | 73.5         | 87.0             | 72.0             | .23       | 2            |
| March .....     | 82.8         | 73.3         | 90.0             | 70.0             | 12.52     | 15           |
| April .....     | 80.0         | 71.7         | 88.0             | 68.5             | 39.01     | 25           |
| May .....       | 79.8         | 70.6         | 83.0             | 69.0             | 14.44     | 21           |
| June .....      | 80.0         | 69.4         | 83.0             | 66.0             | 6.19      | 14           |
| July .....      | 78.2         | 68.5         | 81.0             | 65.0             | 3.58      | 15           |
| August .....    | 78.5         | 68.2         | 79.0             | 66.0             | 2.35      | 16           |
| September ..... | 79.9         | 69.1         | 84.0             | 64.0             | 3.54      | 7            |
| October .....   | 83.5         | 70.6         | 87.0             | 68.0             | 2.92      | 8            |
| November .....  | 84.4         | 73.3         | 90.0             | 71.0             | 4.98      | 11           |
| December .....  | 84.1         | 73.9         | 90.5             | 70.0             | 10.89     | 14           |
| Year .....      | 81.6         | 71.3         | 90.5             | 64.0             | 101.28    | 153          |

Extreme Range of Temperature..... 26°-5

Mr. Burt appends to his report the following remarks on the year:—

As will be seen by comparison with the observations recorded in *Symons's Meteorological Magazine* for March, 1905, the past year shows a slight fall in temperature; this is, no doubt, owing to the unusual amount of cloud which we had. It is interesting to notice the considerable increase in the rainfall—the largest since 1899. I am still of opinion that the light rainfall which we have experienced during the past few years has been abnormal. The autumn (?) rains which usually fall in November were late this year, scarcely getting over before the year closed.

### ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, March 21st, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

The following were elected Fellows:—Mr. C. Anthony, junr., M.Inst.C.E., Mr. L. C. W. Bonacina, Miss E. H. Corder, Capt. R. H. Douglas, Raja Kushal Pal Singh, M.A., Mr. R. H. Rhind, Prof. A. Schuster, F.R.S., Mr. M. Sutton and Mr. W. J. Ware.



This being the "popular" meeting of the session, Dr. H. R. Mill, at the request of the Council, gave a lantern lecture on "South Africa as seen by a Meteorologist." The lecture was illustrated by more than sixty lantern slides from photographs taken by the lecturer during the African wanderings of the British Association in 1905, and bearing some relation to the climate of the countries passed through. While no attempt was made to give an account of the climate of South Africa or a detailed description of the observing stations maintained in the various colonies, a general idea was conveyed, as much in pictures as by words, of the actual condition of things. Travelling in the dry season, the lecturer was naturally impressed with the drought and dust, and had much to say on the importance of systematic irrigation if the natural resources of the country are to be developed to the full. A detailed report here is unnecessary, as a description of the British Association trip has already appeared in this Magazine.

On the motion of the President, seconded by Mr. F. Campbell Bayard, a hearty vote of thanks was accorded to the lecturer.

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

### SNOW ON THE SURREY HILLS.

THE remarkable phenomenon noted by Mr. B. (p. 29) came under my own observation so recently as March 14th, at 1.55 p.m. By that hour the snow fallen in the night *had actually disappeared* from the southern slopes of the North Downs (N.W. of Dorking)—chalk, with patches of tertiary sands on top in parts—but *was still lying* on the northern slopes of Leith Hill, S.W. of the town, which are lower greensand. Another remarkable and most unusual fact is that the sun had been shining for some hours. The northern slopes of the North Downs and southern slopes of Leith Hill were beyond Mr. B.'s vision and mine; but it is safe to say that the answer to the first part of the editorial question is NO.

LOCAL WISEACRE.

*Dorking, March 18th, 1906.*

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In reply to the question raised by you in your editorial note to my letter in the March number on the localization of snow on the Surrey Hills, on the 24th of February, I have to say that I noticed that

snow was entirely absent from the northern slopes of the portion of the North Downs in question, and that it was present on all sides of the Leith Hill ridge except the western, which I did not see, though at midday the snow had commenced to melt rapidly under the combined influence of warm sunshine and the setting in of a moist south-westerly air current. I have to note, however, that on the morning of the 24th of March I met with an instance of a thaw progressing very slowly on the chalk of the North Downs near Oxted, but very rapidly on the green-sand of the Ide Hill range running parallel to the North Downs between Oxted and Sevenoaks. On the morning of that date the sky was entirely overcast, and the temperature of the air about 36° F.

Though these observations made during February and March on the distribution of snow-covered ground in a few localities in Surrey and Kent have been through force of circumstances fragmentary, they would seem to indicate appreciable differences in the condition of the surface rocks with respect to temperature and humidity.

Two parallel ranges of hills like those in question—the one composed of chalk and covered with thin turf, the other composed of sandstone, with a surface consisting largely of barren heath-land—are obviously far more likely, owing to the different physical constants of chalk and sandstone, to vary in surface temperature at any particular time than two parallel ranges of hills composed of the same kind of rock and productive of the same kind of vegetation. I would strongly urge that some attention be paid to the subject of the permanence of layers of snow over different geological formations by observers in this country while making notes upon future falls of snow, as in this way it may be possible to ascertain definite relationships amid seemingly disconnected phenomena. I find that the subject of soil temperature in connection with snow-covering has been studied in Germany. (*Deutsches Meteorologisches Jahrbuch für 1901*).

The character of the snow-clouds, with respect to crystalline texture, boldness of form, and sharpness of outline, has this month been very beautiful and typical of the early spring. Late in the afternoon of the 24th instant, as I was watching from the summit of Ide Hill the dark rugged masses of cumulo-form clouds delicately underlined with silver or tinged with pink, and the squalls of snow amid ever-varying effects of light and shadow, drift slowly across the richly-wooded weald of Kent, I could not but feel that it is in harsh seasons like the present, when the returning sun must make a fierce struggle with the forces tending to protract the cold, that the spirit of the early spring in the open country in these higher latitudes is most magnificently expressed.

L. C. W. BONACINA.

March 27th, 1906.

## COLD IN FEBRUARY AND MARCH.

It is a curious fact (perhaps nothing more) that in each case of the last five sunspot maxima, the year following has had both February and March warm. Assuming last year (1905) to be a maximum year, it seemed not unlikely that the two months this year would "follow suit." They have not done so, being both cold. There seems to be good evidence of a general tendency to earlier springs (in our London region, at least) about the time of sunspot maxima. Individual years are of no great account, I take it, in these inquiries. It will be of more interest to see whether groups of (say) five years about and after the present maximum, present an average February-March temperature conforming to past experience.

Another view may be taken. With two big spots on the sun at present (4th April), it may perhaps be doubted whether we have passed the maximum yet.

In a recent letter I referred to the idea of our air temperature going down in consequence of a large quantity of ice melting in the Gulf Stream, and the cooled water reaching our shores after a considerable interval. I would here pursue this idea a little further.

Dr. Meinardus recently gave a table in which the character of each season at Newfoundland (from 1860 to 1902), as regards ice, was expressed numerically according to the scale,  $-2$ ,  $-1$ ,  $0$ ,  $+1$ ,  $+2$ , where  $-2$  indicated *little* ice, and  $+2$  *much* ice.\* I have compared each of these annual numbers (*a*) with the cold at Greenwich in the latter part of the *same* year, and (*b*) with that in the earlier part of the *following* year.

The inquiry into (*a*)—comparison being made in the number of frost days in the later half of the same year—revealed nothing very definite; no special tendency. But in the case of (*b*) there is, I think, something of that nature.

Thus, there were 10 years at Newfoundland with values  $+2$  or  $+1.5$  (much ice), and 8 of these were followed by an *excess* of frost days in the earlier half of the next year at Greenwich, 2 by a deficiency. On the other hand, out of 9 years with values  $-2$  or  $-1.5$ , 7 were followed by *little* frost at Greenwich in the earlier half of the next year, while in 2 there was (slight) excess.

The mean temperature of each of the first three months appears to be marked by this tendency, which is most pronounced in March. Thus, there were in all 19 seasons at Newfoundland with ice in excess of the average, and of these 14 were followed in Greenwich by cold Marches. Similarly of 19 seasons with ice under average, 14 were followed by warm Marches.

Last year (1905) there was much ice in the Newfoundland region, but I am unable to say how precisely it would be characterised in the above scale. Are we to suppose, in view of the figures just given,

\* A translation of Dr. Meinardus's important paper will be found in the *Quarterly Journal* of the Royal Meteorological Society for January last.

that our recent cold in those two months has been due to an ice-cooled Gulf Stream? The facts seem, at least, to suggest the desirability of further observation of those relations. A timely warning of excessive cold in the early part of the year might possibly be found in the reports of the Newfoundland ice in the previous spring and summer.

ALEX. B. MACDOWALL.

*Southgate, Buxton, 4th April, 1906.*

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### UNUSUAL SKY COLOURS.

YESTERDAY at 7 p.m. the entire canopy of the heavens in Torquay was diffused with a brilliant light green, having slight traces of yellow, N.N.W. on the immediate horizon. This was succeeded by a brilliant ultramarine blue, radiating also from the N.N.W. The entire day and Monday were remarkably bright and clear.

HENRY BEDFORD.

*St. Michael's View, Crown Hill, Torquay, April 4th, 1906.*

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### REVIEWS.

*Cloud Studies.* By ARTHUR W. CLAYDEN, M.A., *Principal of the Royal Albert Memorial College, Exeter.* London: John Murray. 1905. Size 8 x 6. Pp. xiv. + 184; 61 Plates. Price 12s. net.

ONE of the books which is not only worth reading, but worth buying. Mr. Clayden writes shortly, but all he says is fresh, solid and interesting, while the beautifully reproduced photographs of clouds are the finest we have seen. The difficulty of obtaining a clear photograph of a faint white cloud on a deep blue sky is pretty familiar to all who have handled a camera; but the methods of overcoming the difficulty here expounded will be new to most amateurs. Some of Mr. Clayden's finest results, showing the exquisitely minute structure of the faintest and loftiest clouds, were obtained by directing the camera, not towards the cloud itself, but towards the reflection in a mirror of black glass, set at an angle which reduces the intensity of the polarized light of the blue sky while giving full effect to the unpolarized light reflected by the white cloud.

Mr. Clayden executed a series of important cloud measurements for altitude at Exeter by the device of having two cameras at the end of a measured base of 200 yards, each pointed so as to include in the same picture the cloud under observation and the sun. Knowing the date and hour, nothing further is required in order to obtain the height of any part of the cloud above the surface by simple measurement on the plate. The greater part of the book, however, is devoted to a discussion of the minor differences in the

recognized cloud forms, and although at first sight the number of sub-forms strikes one as alarmingly large, the illustrations seem to justify them.

The basis of the classification is that formally adopted by the International Meteorological Committee and embodied in the well-known International Cloud Atlas. Mr. Clayden does not look on this classification with unmixed approval, but with a caution and consideration which cannot be too much praised he refrains from putting forward a new system, trusting that in time the classification will be overhauled by the authoritative body which introduced it. He adds to the classification, however, by suggesting a large number of specific forms of the accepted cloud genera, and he proposes names for these, some of them adopted from Clement Ley, many of which will probably pass into use. He gives, for instance, nine distinct forms of Cirrus, viz., *Cirro-nebula*, *Cirro-filum*, *Cirrus excelsus*, *Cirrus ventosus*, *Cirrus nebulosus*, *Cirrus caudatus*, *Cirrus vittatus*, *Cirrus inconclans*, and finally *Cirrus communis*. The other cloud forms are similarly dealt with.

A very interesting part of the book is the attempt to associate the particular forms of the clouds, and the changes which these forms undergo, with the physical conditions giving rise to them. In this connection the study of the cumulo-nimbus, or thunder cloud, strikes us as particularly happy, while there is a great deal of acute observation and careful reasoning in the short chapter devoted to wave-forms in clouds. The work of Mr. Clayden is a solid contribution to what may be called the vertical exploration of the atmosphere, a direction in which the early years of the twentieth century have already witnessed great progress. Apart from its scientific value, the book will appeal to many who are mere Gallios in meteorology on account of the exquisite beauty of the illustrations.

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*An Introduction to Practical Geography.* By A. T. SIMMONS, B.Sc., and HUGH RICHARDSON, M.A. London: Macmillan & Co. 1905. Size 7 x 4½. Pp. xii. + 380.

A BOOK of admirable intentions very well carried out. It consists largely of a series of exercises in geometrical drawing and calculation adapted to the construction, interpretation and use of maps illustrating all sorts of distributions; but it also contains excellent practice in out-of-door work invaluable to a student of geography. Our readers will probably find the chief interest and utility of the book in its treatment of the diagrammatic representation of variable quantities. More than 100 pages are devoted to Climate, and although this section is well and conscientiously done, a few points present themselves for comment from the point of view of a meteorologist. For instance, on p. 215, the ordinary hours for reading meteorological instruments in this country (9 a.m. and 9 p.m.) are not mentioned, though several quite unusual hours are quoted. We

note with surprise, on p. 225, the use of the extremely objectionable expression, "above or below the equator," when "north or south of the equator" is meant. On p. 232, "Tropical" is inadvertently used in the second table for places all of which lie outside the tropics. On p. 235, the latitude of Ben Nevis as given would sink that mountain and the remains of its observatory in the deep sea. The rain gauge figured on p. 278 is a pattern which should be avoided as it combines the worst defects of two practically obsolete types, while the measuring glass shown beside it can measure only 45 in. These defects are serious in a book for the use of children at school, but after all this is not a heavy list of matters needing amendment in over 100 pages written by authors who are not specialists, and we have pleasure in welcoming and commending the little book.

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*Ueber die räumliche und zeitliche Verteilung des Wärmegehalts der unteren Luftschicht, [On the distribution in space and time of Heat in the lower stratum of the atmosphere.] Von WALTER KNOCHE. Aus dem Archiv der Deutschen Seewarte xxviii. Jahrgang. Hamburg : 1905. Size  $11\frac{1}{2} \times 9\frac{1}{2}$ . Pp. 46. Plates.*

THE author deals with the distribution of heat, not of temperature, and following von Bezold he uses as an index of the heat in the atmosphere the "equivalent temperature," that is the temperature of the air increased by an amount equivalent to the latent heat present. This thermodynamic treatment throws light on some of the apparent anomalies of the distribution of climate when the actual temperature alone is considered, and the author permits himself to hope that further studies in this direction may yield results of practical value in improved weather forecasts.

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*The Hygiene of the Zones.* By ROBERT DE C. WARD. Reprinted from the Bulletin of the Geographical Society of Philadelphia. Vol. 4. No. 2. January, 1906. Size  $9 \times 6$ . Pp. 28.

AN attempt to give a brief survey of some of the relations between weather and climate and a few of the more important diseases. The author shows by many instances that the influence of climate in the production of disease is by no means so great as was formerly supposed, yet that it acts in many ways, direct and indirect. Hygiene is more than climate, yet climate has to be considered, because it affects our bodily comfort, may depress or exhilarate, may induce to remain indoors inactive or tempt to exercise in the open air. In connection with this paper we are reminded of the Committee of the British Association which is now at work, under the presidency of Sir Lauder Brunton, investigating the relation between climate and disease. Anyone able to afford information on the subject should apply to the Secretary of the Committee, Mr. J. Barcroft, King's College, Cambridge.

*Some Aspects of Meteorology.* By HENRY MELLISH. (*Reprinted from the 53rd Report and Transactions of the Nottingham Naturalists' Society for 1904-05.*) Size  $9 \times 5\frac{1}{2}$ . Pp. 8. Plates.

IN this interesting little paper Mr. Mellish gives a rainfall map of Nottinghamshire based on 30 years' averages, and refers in some detail to several aspects of the problem of the distribution and the destination of rainfall.

### METEOROLOGICAL NEWS AND NOTES.

A COURSE OF FOUR LECTURES ON METEOROLOGY, at the University of London, South Kensington, is announced. The subject is "The Atmospheric Circulation and its relation to Weather," and the lectures will be given at 5 p.m., on May 1st, 8th, 15th, and 24th, 1906, by Dr. W. N. Shaw, Director of the Meteorological Office. The following is a syllabus of the lectures:—

I. Atmospheric currents and the distribution of pressure over the globe. Buys Ballot's law and its dynamical significance. Forces which guide the motion of air. Currents in the upper air as determined by observations of cloud and by calculation of the distribution of pressure.

II. Persistent and periodical winds, tropical revolving storms, cyclonic depressions of middle latitudes and the weather associated with them.

III. The normal general circulation at the surface and in the upper air. Relation of temperature and rainfall to the general circulation and local disturbances.

IV. Variations in the several elements of the circulation from year to year. The relation of wheat crop to rainfall and its meteorological significance. Sequences in seasonal variations, with illustrations from the Meteorology of Indian Ocean and of the Atlantic Ocean. Attempts to identify the law of sequence of meteorological changes.

There is no fee for the lectures, and cards of admission may be obtained on application to the Academic Registrar, Mr. P. J. Hartog, The University of London, South Kensington, S.W.

THE METEOROLOGICAL OFFICE has appointed as Superintendent of the Statistical Branch, Mr. R. G. K. Lempfert, whose duties, we understand, will include the preparation of the Weekly Weather Report, and the Reports for the Registrars General of England and Ireland, which are prepared by the Meteorological Office, as well as the supervision of the Library. As Superintendent of the Instruments Branch Mr. Ernest Gold, a distinguished graduate of the University of Cambridge, has been appointed. Mr. J. A. Curtis succeeds Mr. J. S. Harding as Cashier and Chief Clerk of the Office.

MR. H. E. WOOD, formerly demonstrator in the Physical Laboratory in the University of Manchester, has been appointed Assistant Meteorologist in the Johannesburg Observatory of the Transvaal Government.

THE CAMBRIDGE AND HUNTINGDONSHIRE RAINFALL TABLE has been published monthly for circulation amongst the rainfall observers in those counties for twenty years. Conducted at first by Mr. H. G. Fordham and latterly by Mr. Harold Warren, C.E., it was in danger of lapsing when the last-named gentleman left Cambridge early in the present year. The Editor of "British Rainfall," being unwilling to see any well designed plan for promoting interest in so important a matter as the rainfall of two prominent agricultural counties fall to the ground, offered to continue the Table as part of the work of the British Rainfall Organization, if no volunteer were forthcoming to carry it on. He has been held to his word; and readers of this Magazine in the counties mentioned who would care to have the Table and do not already receive it are invited to communicate with the Editor.

TELEGRAPHIC DELAYS owing to the destruction of posts and wires during gales and snowstorms have frequently been commented on in our winter numbers, and it is a pleasure to be able now to record the completion of an underground telegraph cable for the 400 miles from London to Glasgow which may be depended upon to prevent an absolute suspension of communication from south to north in bad weather. The work, which has been carried out by the Post Office, was costly—the sum of £2,000,000 has been mentioned in the newspapers—but the practicability of long underground cables has been proved, and this is another step towards the emancipation of humanity from the adverse powers of the air.

LONG PERIOD WEATHER FORECASTS have always been viewed by meteorologists in an atmosphere of doubt mingled with hope, and confirmation of the following cutting from one of the many newspapers of March 29th which published it will be awaited with interest:—

NEW YORK, March 28.—At a banquet which was given here yesterday evening by the Maritime Association, Mr. Moore, chief of the Weather Bureau, announced that the Bureau believed it had a basis for forecasting the general character of the weather a month in advance, and that it expected to inaugurate a service of this character within a year.—*Reuter*.

EASTER WEEK frequently presents to the Editor of a monthly publication the alternative of going to press too early, and thereby leaving undone some of his best intentions, or of going to press too late, and losing such character for promptitude as he may possess. We have chosen the former alternative, hence there is no article on the rainfall of the winter six months of 1905-06.

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## TEMPERATURE FOR MARCH, 1906.

| STATION.                          | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |          |      |       | No. of Night<br>stor below 32° |        |
|-----------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|----------|------|-------|--------------------------------|--------|
|                                   |                      |            |                      |                                | Max.         |          | Min. |       | Shade.                         | Grass. |
|                                   |                      |            |                      |                                | °            | Date.    | °    | Date. |                                |        |
| Camden Square.....                | London.....          | 51 32      | 0 8                  | 111                            | 65·1         | 7        | 27·3 | 23    | 9                              | 20     |
| Tenterden.....                    | Kent.....            | 51 4       | *0 41                | 190                            | 62·0         | 7        | 27·5 | 24    | 9                              | 20     |
| Hartley Wintney.....              | Hampshire.....       | 51 18      | 0 53                 | 222                            | 60·0         | 7, 18    | 24·0 | 23    | 10                             | 17     |
| Hitchin.....                      | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | 65·0         | 7        | 24·0 | 22    | 15                             | ...    |
| Winslow (Addington).....          | Buckinghamsh. ....   | 51 58      | 0 53                 | 309                            | 67·0         | 7        | 23·0 | 30    | 15                             | 20     |
| Bury St. Edmunds (Westley) ..     | Suffolk.....         | 52 15      | *0 40                | 226                            | 67·0         | 7        | 25·0 | 13    | ...                            | ...    |
| Brundall.....                     | Norfolk.....         | 52 37      | *1 26                | 66                             | ...          | ...      | ...  | ...   | ...                            | ...    |
| Alderbury.....                    | Wiltshire.....       | 51 2       | 1 44                 | 263                            | 63·0         | 7        | 22·0 | 22    | 14                             | ...    |
| Winterbourne Steepleton ..        | Dorset.....          | 50 42      | 2 31                 | 316                            | 58·2         | 6        | 22·7 | 30    | 11                             | 15     |
| Torquay (Cary Green).....         | Devon.....           | 50 28      | 3 32                 | 12                             | 58·5         | 6        | 31·6 | 23    | 1                              | 21     |
| Polapit Tamar [Launceston] ..     | ".....               | 50 40      | 4 22                 | 315                            | 61·0         | 17       | 24·0 | 29    | 10                             | 13     |
| Bath.....                         | Somerset.....        | 51 23      | 2 21                 | 67                             | 65·0         | 17       | 24·5 | 30    | 13                             | ...    |
| Stroud (Upfield).....             | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 60·0         | 6, 7     | 28·0 | 25    | 10                             | ...    |
| Church Stretton (Woolstaston) ..  | Shropshire.....      | 52 35      | 2 48                 | 800                            | 58·0         | 17       | 20·0 | 26    | 23                             | ...    |
| Bromsgrove (Stoke Reformatory) .. | Worcestershire.....  | 52 19      | 2 4                  | 225                            | 60·0         | 8, 17    | 21·0 | 29    | 16                             | ...    |
| Boston.....                       | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 60·0         | 6        | 26·0 | 14    | 13                             | ...    |
| Workshop (Hodsock Priory).....    | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 62·9         | 7        | 23·7 | 14    | 12                             | 19     |
| Derby (Midland Railway).....      | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 63·0         | 8        | 26·0 | 12    | 13                             | ...    |
| Bolton (Queen's Park).....        | Lancashire.....      | 53 35      | 2 28                 | 390                            | 54·5         | 17       | 23·8 | 13    | 11                             | 19     |
| Wetherby (Ribston Hall).....      | Yorkshire, W.R. .... | 53 59      | 1 24                 | 130                            | ...          | ...      | ...  | ...   | ...                            | ...    |
| Arneliffe Vicarage.....           | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...      | ...  | ...   | ...                            | ...    |
| Hull (Pearson Park).....          | "..... E.R. ....     | 53 45      | 0 20                 | 6                              | 61·0         | 6, 7, 17 | 19·0 | 14    | 11                             | 23     |
| Newcastle (Town Moor) ..          | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...      | ...  | ...   | ...                            | ...    |
| Borrowdale (Seathwaite) ..        | Cumberland.....      | 54 30      | 3 10                 | 423                            | 50·5         | 20       | 17·3 | 14    | 10                             | ...    |
| Cardiff (Ely).....                | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...      | ...  | ...   | ...                            | ...    |
| Haverford west (High Street) ..   | Pembroke.....        | 51 48      | 4 58                 | 95                             | 56·2         | 17       | 28·3 | 30    | 5                              | 19     |
| Aberystwyth (Gogerddan).....      | Cardigan.....        | 52 26      | 4 1                  | 83                             | ...          | ...      | ...  | ...   | ...                            | ...    |
| Llandudno.....                    | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 54·0         | 17       | 27·0 | 13    | 4                              | ...    |
| Cargen [Dunfries].....            | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 54·0         | 16       | 17·0 | 14    | 9                              | ...    |
| Lilliesleaf (Riddell House).....  | Rorburgh.....        | 55 31      | 2 46                 | 550                            | 50·0         | 6†       | 10·0 | 13    | 14                             | 25     |
| Edinburgh (Royal Observatory) ..  | Midlothian.....      | 55 55      | 3 11                 | 442                            | 54·1         | 16       | 18·4 | 13    | 10                             | 19     |
| Colmonell (Clachanton).....       | Ayr.....             | 55 8       | 4 54                 | 140                            | 53·0         | 6        | 12·0 | 13    | 11                             | ...    |
| Glasgow (Queen's Park) ..         | Renfrew.....         | 55 53      | 4 18                 | 144                            | 55·0         | 30       | 14·0 | 13    | 13                             | 26     |
| Tighnabruaich.....                | Argyll.....          | 55 55      | 5 14                 | 50                             | 48·0         | 20†      | 20·0 | 13    | 18                             | 20     |
| Mull (Quinish).....               | ".....               | 56 36      | 6 13                 | 35                             | 49·0         | 31       | ...  | ...   | ...                            | ...    |
| Dundee (Eastern Necropolis) ..    | Forfar.....          | 56 28      | 2 57                 | 199                            | 54·6         | 30, 31   | 18·6 | 14    | 16                             | ...    |
| Braemar.....                      | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...      | ...  | ...   | ...                            | ...    |
| Aberdeen (Cranford).....          | ".....               | 57 8       | 2 7                  | 120                            | 51·0         | 30, 31   | 14·0 | 13    | 16                             | ...    |
| Cawdor (Budgate).....             | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...      | ...  | ...   | ...                            | ...    |
| Invergarry.....                   | E. Inverness.....    | 57 4       | 4 47                 | 130?                           | ...          | ...      | ...  | ...   | ...                            | ...    |
| Loch Torridon (Bendampth) ..      | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...      | ...  | ...   | ...                            | ...    |
| Dunrobin Castle.....              | Sutherland.....      | 57 59      | 3 56                 | 14                             | 53·0         | 17       | 19·5 | 13    | 15                             | ...    |
| Castletown.....                   | Caithness.....       | 58 35      | 3 23                 | 100                            | 53·0         | 16 §     | 25·0 | 13    | 8                              | 18     |
| Killarney (District Asylum) ..    | Kerry.....           | 52 4       | 9 31                 | 178                            | 59·0         | 17       | 28·0 | 26    | ...                            | ...    |
| Waterford (Brook Lodge).....      | Waterford.....       | 52 15      | 7 7                  | 104                            | 56·0         | 15       | 29·0 | 3     | 3                              | ...    |
| Broadford (Hurdlestown) ..        | Clare.....           | 52 48      | 8 38                 | 167                            | 53·0         | 31       | 28·0 | 25    | 8                              | ...    |
| Carlow (Browne's Hill).....       | Carlow.....          | 52 50      | 6 53                 | 291                            | ...          | ...      | ...  | ...   | ...                            | ...    |
| Dublin (Fitz William Square) ..   | Dublin.....          | 53 21      | 6 14                 | 54                             | 59·9         | 16       | 31·9 | 3     | 3                              | 12     |
| Ballinasloe.....                  | Galway.....          | 53 20      | 8 15                 | 160                            | 60·5         | 6        | 22·0 | 28    | 14                             | ...    |
| Clifden (Kylemore House).....     | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...      | ...  | ...   | ...                            | ...    |
| Crossmolina (Enniscoe).....       | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...      | ...  | ...   | ...                            | ...    |
| Seaforde.....                     | Down.....            | 54 19      | 5 50                 | 180                            | 55·0         | 6        | 20·0 | 12    | 8                              | 12     |
| Londonderry (Crown Res.) ..       | Londonderry.....     | 54 50      | 7 10                 | 220                            | ...          | ...      | ...  | ...   | ...                            | ...    |

## RAINFALL FOR MARCH, 1906.

## RAINFALL OF MONTH.

## RAINFALL FROM JAN. 1.

| Aver.<br>1870-99.<br>in. | 1906.<br>in. | Diff.<br>from<br>Av.<br>in. | o/o<br>of<br>Av. | Max. in<br>24 hours. |       | No.<br>of<br>Days | Aver.<br>1870-99.<br>in. | 1906.<br>in. | Diff.<br>from<br>Aver.<br>in. | o/o<br>of<br>Av. | Mean<br>Annual<br>1870-<br>1899.<br>in. | STATION.           |
|--------------------------|--------------|-----------------------------|------------------|----------------------|-------|-------------------|--------------------------|--------------|-------------------------------|------------------|-----------------------------------------|--------------------|
|                          |              |                             |                  | in.                  | Date. |                   |                          |              |                               |                  |                                         |                    |
| 1.62                     | 1.08         | — .54                       | 67               | .32                  | 10    | 17                | 5.13                     | 6.99         | +1.86                         | 136              | 25.16                                   | Camden Square      |
| 1.89                     | 1.77         | — .12                       | 94               | .37                  | 10    | 19                | 6.10                     | 7.63         | +1.53                         | 125              | 28.36                                   | Tenterden          |
| 1.77                     | 1.50         | — .27                       | 85               | .29                  | 10    | 19                | 6.22                     | 7.79         | +1.57                         | 125              | 27.10                                   | Hartley Wintney    |
| 1.53                     | 1.83         | + .30                       | 120              | .29                  | 25    | 16                | 4.88                     | 7.00         | +2.12                         | 143              | 24.66                                   | Hitchin            |
| 1.62                     | 1.54         | — .08                       | 95               | .34                  | 10    | 19                | 5.40                     | 7.06         | +1.66                         | 131              | 26.75                                   | Addington          |
| 1.64                     | 2.12         | + .48                       | 129              | .26                  | 1     | 20                | 4.89                     | 8.15         | +3.26                         | 167              | 25.39                                   | Westley            |
| 1.65                     | 2.16         | + .51                       | 131              | .35                  | 24    | 21                | 4.81                     | 8.68         | +3.87                         | 181              | 25.40                                   | Brundall           |
| 1.78                     | .63          | — 1.15                      | 35               | .14                  | 13    | 14                | 6.66                     | 9.06         | +2.40                         | 136              | 29.17                                   | Alderbury          |
| 2.41                     | 1.51         | — .90                       | 63               | .40                  | 13    | 11                | 9.42                     | 14.60        | +5.18                         | 155              | 39.00                                   | Winterbourne Stptn |
| 2.45                     | 1.00         | — 1.45                      | 41               | .27                  | 13    | 11                | 8.51                     | 11.02        | +2.51                         | 129              | 35.00                                   | Torquay            |
| 2.41                     | 2.02         | — .39                       | 84               | .58                  | 1     | 16                | 9.12                     | 14.82        | +5.70                         | 163              | 38.85                                   | Polspit Tamar      |
| 1.94                     | 1.69         | — .25                       | 87               | .45                  | 10    | 16                | 6.58                     | 8.04         | +1.46                         | 122              | 30.75                                   | Bath               |
| 1.86                     | 1.53         | — .33                       | 82               | .40                  | 10    | 17                | 6.45                     | 8.05         | +1.60                         | 125              | 29.85                                   | Stroud             |
| 2.01                     | 1.40         | — .61                       | 70               | .26                  | 7     | 17                | 7.09                     | 8.21         | +1.12                         | 116              | 33.04                                   | Woolstaston        |
| 1.36                     | .82          | — .54                       | 60               | .23                  | 10    | 11                | 4.90                     | 5.87         | + .97                         | 120              | 24.50                                   | Bromsgrove         |
| 1.36                     | 1.76         | + .40                       | 129              | .30                  | 23    | 18                | 4.50                     | 6.66         | +2.16                         | 148              | 23.30                                   | Boston             |
| 1.55                     | 1.28         | — .27                       | 83               | .24                  | 1     | 16                | 4.87                     | 6.15         | +1.28                         | 126              | 24.70                                   | Hodsock Priory     |
| 1.49                     | 1.51         | + .02                       | 101              | .32                  | 1     | 17                | 5.10                     | 7.36         | +2.26                         | 144              | 26.18                                   | Derby              |
| 2.88                     | 3.35         | + .47                       | 116              | .78                  | 7     | 17                | 8.93                     | 14.34        | +5.41                         | 161              | 42.43                                   | Bolton             |
| 1.85                     | 1.53         | — .32                       | 83               | .37                  | 24    | 16                | 5.37                     | 7.53         | +2.16                         | 140              | 26.96                                   | Ribston Hall       |
| 5.03                     | 6.37         | +1.34                       | 127              | 1.55                 | 7     | 23                | 16.10                    | 22.02        | +5.92                         | 137              | 60.96                                   | Arnccliffe Vic.    |
| 1.79                     | 1.65         | — .14                       | 92               | .21                  | 18    | 17                | 5.45                     | 5.86         | + .41                         | 108              | 27.02                                   | Hull               |
| 2.10                     | 1.24         | — .86                       | 59               | .22                  | 10    | 15                | 5.64                     | 4.71         | — .93                         | 84               | 27.99                                   | Newcastle          |
| 10.51                    | 9.38         | — 1.13                      | 89               | 1.56                 | 15    | 17                | 36.86                    | 38.65        | +1.79                         | 105              | 132.68                                  | Seathwaite         |
| 2.79                     | 3.12         | + .33                       | 112              | 1.07                 | 10    | 15                | 9.77                     | 14.81        | +5.04                         | 152              | 42.81                                   | Cardiff            |
| 3.03                     | 2.97         | — .06                       | 98               | 1.12                 | 10    | 16                | 11.86                    | 14.37        | +2.51                         | 121              | 47.88                                   | Haverfordwest      |
| 2.93                     | 3.81         | + .88                       | 130              | 1.17                 | 10    | 15                | 9.83                     | 15.20        | +5.37                         | 155              | 45.41                                   | Gogerddan          |
| 1.97                     | 3.15         | +1.18                       | 160              | .88                  | 7     | 15                | 6.51                     | 9.97         | +3.46                         | 153              | 30.98                                   | Llandudno          |
| 3.01                     | 2.49         | — .52                       | 83               | .52                  | 10    | 12                | 11.17                    | 9.86         | — 1.31                        | 88               | 43.43                                   | Cargen             |
| 2.40                     | 1.60         | — .80                       | 67               | .38                  | 11    | 15                | 7.41                     | 6.02         | — 1.39                        | 81               | 33.04                                   | Riddell House      |
| ...                      | 1.87         | ...                         | ...              | .57                  | 11    | 14                | ...                      | 6.09         | ...                           | ...              | ...                                     | Edinburgh          |
| 3.18                     | 2.62         | — .56                       | 82               | .58                  | 14    | 13                | 11.37                    | 10.35        | — 1.02                        | 91               | 44.85                                   | Colmonell          |
| 2.33                     | 3.53         | +1.20                       | 152              | 1.10                 | 14    | 9                 | 8.11                     | 11.14        | +3.03                         | 137              | 35.80                                   | Glasgow            |
| 4.36                     | 5.35         | + .99                       | 123              | 1.69                 | 16    | 14                | 14.79                    | 18.74        | +3.95                         | 127              | 57.90                                   | Tighnabruaich      |
| 4.23                     | 2.68         | — 1.55                      | 63               | .76                  | 16    | 19                | 14.58                    | 14.14        | — .44                         | 97               | 57.53                                   | Quinish            |
| 1.92                     | 1.05         | — .87                       | 55               | .25                  | 11    | 12                | 6.12                     | 3.80         | — 2.32                        | 62               | 28.95                                   | Dundee             |
| 2.42                     | 2.96         | + .54                       | 122              | ...                  | ...   | ...               | 8.03                     | 9.46         | +1.43                         | 118              | 36.97                                   | Braemar            |
| 2.43                     | 2.20         | — .23                       | 91               | .45                  | 11    | 20                | 7.18                     | 6.29         | — .89                         | 88               | 33.01                                   | Aberdeen           |
| 2.16                     | 2.92         | + .76                       | 135              | .53                  | 16    | 19                | 6.16                     | 7.86         | +1.70                         | 128              | 29.37                                   | Cawdor             |
| 4.83                     | 3.30         | — 1.53                      | 68               | .95                  | 16    | 6                 | 16.35                    | 18.25        | +1.90                         | 112              | 56.00                                   | Invergarry         |
| 6.38                     | 8.52         | +2.14                       | 134              | 1.75                 | 6     | 29                | 21.90                    | 29.72        | +7.82                         | 136              | 86.50                                   | Bendampth          |
| 2.47                     | 2.41         | — .06                       | 98               | .54                  | 14    | 12                | 7.48                     | 11.09        | +3.61                         | 148              | 31.60                                   | Dunrobin Castle    |
| ...                      | 2.31         | ...                         | ...              | .37                  | 8     | 26                | ...                      | 11.55        | ...                           | ...              | ...                                     | Castletown         |
| 4.03                     | 2.52         | — 1.51                      | 63               | .66                  | 11    | 17                | 16.04                    | 13.52        | — 2.52                        | 84               | 58.11                                   | Killarney          |
| 2.55                     | 1.81         | — .74                       | 71               | .45                  | 10    | 14                | 9.91                     | 10.36        | + .45                         | 104              | 39.30                                   | Waterford          |
| 2.17                     | 2.26         | + .09                       | 104              | .38                  | 10    | 15                | 7.34                     | 10.49        | +3.15                         | 143              | 33.47                                   | Hurdlestown        |
| 2.26                     | 2.56         | + .30                       | 113              | .60                  | 10    | 15                | 8.02                     | 9.04         | +1.02                         | 113              | 34.44                                   | Carlow             |
| 1.85                     | 1.52         | — .33                       | 82               | .48                  | 10    | 17                | 5.99                     | 7.29         | +1.30                         | 122              | 27.75                                   | Dublin             |
| 2.45                     | 2.58         | + .13                       | 105              | .64                  | 10    | 19                | 8.42                     | 11.32        | +2.90                         | 134              | 37.04                                   | Ballinasloe        |
| 5.67                     | 3.46         | — 2.21                      | 61               | .82                  | 10    | 14                | 19.61                    | 20.59        | + .98                         | 105              | 80.23                                   | Kylmore House      |
| 3.95                     | 3.53         | — .42                       | 89               | .73                  | 10    | 19                | 12.96                    | 15.45        | +2.49                         | 119              | 50.50                                   | Enniscece          |
| 2.56                     | 1.97         | — .59                       | 77               | .40                  | 1     | 15                | 9.16                     | 7.99         | — 1.17                        | 87               | 38.61                                   | Seaforde           |
| 3.06                     | 3.39         | + .33                       | 111              | .66                  | 11    | 20                | 9.35                     | 13.10        | +3.75                         | 140              | 41.20                                   | Londonderry        |
| 2.47                     | 3.60         | +1.13                       | 146              | .61                  | 14    | 18                | 8.30                     | 11.94        | +3.64                         | 144              | 37.85                                   | Omagh              |

## SUPPLEMENTARY RAINFALL, MARCH, 1906.

| Div.  | STATION.                          | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | 1.86            | XI.    | Rhayader, Tyrmynydd .....         | 5.61            |
| "     | Ramsgate, West Cliff Villas ..... | 1.74            | "      | Lake Vyrnwy .....                 | 5.08            |
| "     | Hailsham .....                    | 1.65            | "      | Llanghanfal, Plas Draw .....      | 2.38            |
| "     | Crowborough, Uckfield Lodge ..... | 2.41            | "      | Criccieth, Talarvor .....         | 2.87            |
| "     | Osborne, Newbarn Cottage .....    | 1.36            | "      | Llanberis, Pen-y-pass .....       | 13.50           |
| "     | Einsworth, Redlands .....         | 1.32            | "      | Lligwy .....                      | 3.03            |
| "     | Alton, Ashdell .....              | 1.50            | "      | Douglas, Woodville .....          | 2.31            |
| "     | Newbury, Welford Park .....       | 2.02            | XII.   | Stoneykirk, Ardwell House .....   | 1.59            |
| III.  | Harrow Weald, Hill House .....    | 1.34            | "      | Dalry, The Old Garroch .....      | 4.73            |
| "     | Oxford, Magdalen College .....    | 1.27            | "      | Langholm, Drove Road .....        | ...             |
| "     | Bloxham Grove .....               | 1.14            | "      | Moniaive, Maxwellton House .....  | 3.39            |
| "     | Pitsford, Sedgebrook .....        | 1.32            | XIII.  | N. Esk Reservoir [Penicuik] ..... | 3.35            |
| "     | Huntingdon, Brampton .....        | 1.84            | XIV.   | Maybole, Knockdon Farm .....      | 3.29            |
| "     | Wisbech, Bank House .....         | 1.66            | "      | Campbeltown, Witchburn .....      | 3.15            |
| IV.   | Southend Water Works .....        | 1.11            | XV.    | Inveraray, Newtown .....          | 6.28            |
| "     | Colchester, Lexden .....          | 1.51            | "      | Ballachulish House .....          | 6.31            |
| "     | Newport, The Vicarage .....       | 1.79            | "      | Islay, Eallabus .....             | 3.43            |
| "     | Rendlesham .....                  | 1.85            | XVI.   | Dollar Academy .....              | 3.17            |
| "     | Swaffham .....                    | 1.74            | "      | Loch Leven Sluice .....           | 2.68            |
| "     | Blakeney .....                    | 1.63            | "      | Balquhider, Stronvar .....        | ...             |
| V.    | Bishops Cannings .....            | 1.79            | "      | Perth, Pitcullen House .....      | 1.92            |
| "     | Ashburton, Druid House .....      | 1.75            | "      | Coupar Angus Station .....        | 1.19            |
| "     | Okehampton, Oaklands .....        | 2.79            | "      | Blair Atholl .....                | 2.22            |
| "     | Hartland Abbey .....              | 1.67            | "      | Montrose, Sunnyside Asylum .....  | .33             |
| "     | Lynmouth, Rock House .....        | 2.84            | XVII.  | Alford, Lynturk Manse .....       | 2.40            |
| "     | Probus, Lamellyn .....            | 1.19            | "      | Keith Station .....               | 3.03            |
| "     | Wellington, The Avenue .....      | 1.71            | XVIII. | N. Uist, Lochmaddy .....          | 1.61            |
| "     | North Cadbury Rectory .....       | 1.54            | "      | Alvey Manse .....                 | 2.84            |
| VI.   | Clifton, Pembroke Road .....      | 2.81            | "      | Loch Ness, Drumnadrochit .....    | 3.50            |
| "     | Moreton-in-Marsh, Longbore .....  | 1.52            | "      | Glencarron Lodge .....            | 9.46            |
| "     | Ross, The Graig .....             | 1.10            | "      | Fearn, Lower Pitkerrie .....      | 1.56            |
| "     | Shifnal, Hatton Grange .....      | 1.26            | XIX.   | Inverashin .....                  | 2.45            |
| "     | Cheadle, The Heath House .....    | 2.43            | "      | Altnaharra .....                  | 4.16            |
| "     | Coventry, Kingwood .....          | 1.37            | "      | Bettyhill .....                   | 2.92            |
| VII.  | Market Overton .....              | 1.46            | "      | Watten Station .....              | 1.37            |
| "     | Market Rasen .....                | 2.14            | XX.    | Dunmanway, The Rectory .....      | 3.15            |
| "     | Rawtry, Hesley Hall .....         | .82             | "      | Cork .....                        | 1.16            |
| VIII. | Neston, Hinderton .....           | 1.83            | "      | Darrynane Abbey .....             | 2.33            |
| "     | Southport, Hesket Park .....      | 2.58            | "      | Glenam [Clonmel] .....            | 2.30            |
| "     | Chatburn, Middlewood .....        | 4.27            | "      | Ballingarry, Gurteen .....        | 2.46            |
| "     | Cartmel, Flookburgh .....         | 3.95            | "      | Miltown Malbay .....              | 3.29            |
| IX.   | Langsett Moor, Up. Midhope .....  | 4.20            | XXI.   | Gorey, Courtown House .....       | 1.86            |
| "     | Scarborough, Scalby .....         | 2.16            | "      | Moynalty, Westland .....          | 2.16            |
| "     | Ingleby Greenhow .....            | 2.11            | "      | Athlone, Twyford .....            | 2.45            |
| "     | Mickleton .....                   | 2.10            | "      | Mullingar, Belvedere .....        | 1.92            |
| X.    | Bardon Mill, Beltingham .....     | 2.03            | XXII.  | Woodlawn .....                    | 3.02            |
| "     | Ewesley, Fallowles .....          | ...             | "      | Westport, Murrisk Abbey .....     | 3.37            |
| "     | Ilderton, Lilburn Cottage .....   | 1.58            | "      | Collooney, Markree Obay .....     | 3.72            |
| "     | Keswick, York Bank .....          | 4.02            | XXIII. | Enniskillen, Portora .....        | 2.58            |
| XI.   | Llanfrechfa Grange .....          | 2.37            | "      | Warrenpoint, Summer Hill .....    | 1.49            |
| "     | Treherbert, Tyn-y-waun .....      | 6.34            | "      | Banbridge, Milltown .....         | 1.76            |
| "     | Carmarthen, The Friary .....      | 3.03            | "      | Belfast, Springfield .....        | 2.96            |
| "     | Castle Malgwyn [Llechryd] .....   | 3.20            | "      | Bushmilla, Dundarave .....        | 2.46            |
| "     | Plynlimon .....                   | 11.20           | "      | Stewartstown, The Square .....    | 2.70            |
| "     | Tall-y-llyn .....                 | 2.60            | "      | Killybegs .....                   | 4.82            |
| "     | New Radnor, Ednol .....           | 3.04            | "      | Horn Head .....                   | 3.97            |

## METEOROLOGICAL NOTES ON MARCH, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—The first and last weeks were fine and sunny, but in the intermediate period R or S fell on practically every day in small quantities, with much high wind. The temp. was for the most part somewhat below the normal, but the mean for the month was 42°3, or 0°2 above the average. Duration of sunshine 99·4\* hours, and of R 43·5 hours.

CROWBOROUGH.—Variable till 18th and mild on the whole, but wintry weather on 19th with night frosts and continual light S. The month closed calm and mild. Mean temp. 38°1, or 2°4 below the average, and 5°2 below that of March, 1905. R ·05 in. above the average.

BLAKENY.—On 12th, with a heavy N.E. to N.W. gale, occurred the highest tide since November, 1897. No damage was done here, but at Cley many houses were inundated.

TORQUAY.—Mean temp. 44°2, or 0°1 above the average. Duration of sunshine 148·3\* hours, or 9·1 hours above the average. Mean amount of ozone 5·7.

NORTH CADDURY.—Judging by means, a normal March, but in fact most abnormal. Till 18th it was unusually warm, with S.W. wind and R. From 19th to 29th was the coldest period of the whole winter, with N. and N.E. winds and frequent S, but plenty of sunshine.

CLIFTON.—The first week was fine, then R or S fell every day till 16th. The remainder was mostly dry, with slight frosts and keen N.E. winds. R ·37 in. above the average.

BOLTON.—Bright and sunny, the duration of sunshine being 93·7\* hours, or 17·6 hours above the average. Cold N. and E. winds prevailed.

CARMARTHEN.—The first three weeks were wet and cold, with some H, sleet and S, hindering work on farms and gardens. The latter part was exceptionally cold and dry, with bitter N. and N.E. winds.

GOGERDDAN.—From 1st to 15th was rough and boisterous from W. and N.W., the wind amounting to strong gales at times with R. Cold drying E. and N.E. winds and strong sunshine from 15th to the end.

DOUGLAS.—Very stormy and colder than either January or February, with falls of S and H and slight frosts. A series of strong N.E. and N.W. winds set in on 11th and prevailed throughout the remainder of the month, causing extremely cold weather.

DUMFRIES.—The low temp. and biting E. winds of the latter half greatly checked vegetation, but a better time for sowing the corn crop has hardly ever been experienced.

RIDDELL.—A typical March; it "came in like a lion and went out like a lamb." There was much N. wind, gales, R and S, and everything was disagreeable till the last four days.

INVERARAY.—There was an extraordinary fall of 2·90 in. of R on 16th, but it appears to have been local.

COUPAR ANGUS.—Cold after the first week, with N. winds and S, which drifted in places, blocking the roads. R ·90 in. below the average.

DRUMNADROCHIT.—The coldest and stormiest of the winter months. There was considerable flooding from melting S. R ·51 in., and rainy days 6, above the average of 20 years. Aurora borealis on 24th.

DUNMANWAY.—The traditional March; cold and dry, with much N.E. wind and bright sunshine.

CORK.—R less than half the average. The mean temp. of the first 18 days was 44°8 and of the last 13, 39°6.

DARBYNANE ABBEY.—The first half was mild and wet, the second dry and cold, except the last three days. R 70 per cent. of the average.

OMAGH.—The first fortnight was raw and very wet, with frequent H, sleet and S showers, and some sharp night frosts, but the latter part was made up of typical March weather, with strong N.E. winds drying the ground and enabling a large breadth of cereal crops to be sown in excellent order.

## Climatological Table for the British Empire, October, 1905.

| STATIONS.<br><br><i>(Those in italics are<br/>South of the Equator.)</i> | Absolute. |       |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain. |       | Aver.  |
|--------------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|-------------|-------|--------|
|                                                                          | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.      | Days. | Cloud. |
|                                                                          | Temp.     | Date. | Temp.    | Date. |          |      |               |           |                 |                   |             |       |        |
|                                                                          |           |       |          |       |          |      |               |           |                 |                   |             |       |        |
| London, Camden Square                                                    | 61·0      | 9     | 27·8     | 22    | 53·8     | 38·7 | 40·9          | 85        | 97·9            | 23·7              | 1·40        | 14    | 5·9    |
| Malta.....                                                               | 82·5      | 6     | 56·9     | 21    | 73·3     | 62·2 | 59·2          | 80        | 132·6           | 51·7              | 2·94        | 11    | 4·7    |
| Lagos.....                                                               | 87·0      | 13a   | 69·0     | 16    | 83·9     | 73·9 | 73·9          | 81        | 144·0           | 63·0              | 5·99        | 17    | 7·7    |
| Cape Town .....                                                          | 86·8      | 31    | 47·1     | 8     | 67·5     | 52·9 | 52·5          | 74        | ...             | ...               | 1·42        | 12    | 5·1    |
| Durban, Natal .....                                                      | 86·9      | 19    | 49·5     | 2     | 77·2     | 61·8 | ...           | ...       | 143·8           | ...               | 3·87        | 14    | 5·7    |
| Johannesburg .....                                                       | 87·8      | 18    | 35·7     | 1     | 78·4     | 53·8 | 43·4          | 49        | 164·0           | 33·5              | ·85         | 4     | 1·5    |
| Mauritius.....                                                           | 85·1      | 28    | 59·1     | 4     | 81·5     | 65·5 | 63·2          | 72        | 150·0           | 51·2              | 1·99        | 18    | 5·4    |
| Calcutta.....                                                            | 90·9      | 4     | 68·9     | 30    | 87·4     | 74·9 | 74·0          | 81        | 137·0           | 63·8              | 4·78        | 7     | 4·8    |
| Bombay.....                                                              | 94·7      | 8     | 74·9     | 30    | 89·7     | 78·1 | 75·2          | 77        | 141·0           | 68·0              | ·20         | 5     | 8·6    |
| Madras.....                                                              | 93·7      | 28    | 66·7     | 28    | 88·6     | 74·9 | 74·7          | 84        | 145·2           | 62·2              | 19·65       | 15    | 5·3    |
| Kodalkanal .....                                                         | 69·0      | 1     | 46·4     | 30    | 63·4     | 51·4 | 46·1          | 73        | 143·9           | 32·6              | 15·36       | 18    | 5·3    |
| Colombo, Ceylon.....                                                     | 87·7      | 5b    | 72·4     | 10    | 85·5     | 75·1 | 74·4          | 86        | 149·8           | 71·4              | 14·81       | 19    | 6·1    |
| Hongkong.....                                                            | 85·7      | 19    | 56·7     | 21    | 80·4     | 72·0 | 66·3          | 71        | 147·1           | ...               | 1·83        | 4     | 4·9    |
| Melbourne.....                                                           | 72°0      | 10c   | 36·0     | 8     | 59·9     | 45·5 | 43·4          | 77        | 135·1           | 28·4              | 2·57        | 16    | 6·9    |
| Adelaide.....                                                            | 77°0      | 5     | 38·9     | 20    | 61·3     | 46·1 | 44·0          | 67        | 139·0           | 32·4              | 2·90        | 18    | 5·8    |
| Coolgardie .....                                                         | 89·6      | 20    | 39·0     | 11    | 73·2     | 47·2 | 40·4          | 48        | 152·0           | 35·2              | ·61         | 5     | 3·7    |
| Sydney.....                                                              | 84·7      | 6     | 44·1     | 9     | 67·2     | 50·8 | 46·8          | 64        | 123·8           | 32·7              | 2·31        | 26    | 5·1    |
| Wellington .....                                                         | 64°0      | 24    | 41·3     | 15    | 59·0     | 48·3 | 46·0          | 76        | 126·0           | 36·0              | 6·17        | 18    | 7·0    |
| Auckland.....                                                            | 66·5      | 30    | 44·0     | 15    | 60·8     | 49·9 | 48·7          | 79        | 136·0           | 38·0              | 5·87        | 21    | 5·8    |
| Jamaica, Negril Point..                                                  | 89·9      | 24    | 70·9     | 18    | 86·9     | 73·3 | 74·6          | 81        | ...             | ...               | 11·14       | 10    | ...    |
| Trinidad.....                                                            | 91°0      | 4     | 70°0     | sev.  | 88·6     | 71·7 | 74°0          | 82        | 169°0           | 67°0              | 6·94        | 17    | ...    |
| Grenada.....                                                             | 88°0      | 7     | 72°0     | 20    | 84·9     | 75·3 | 72·7          | 77        | 150°0           | ...               | 8·73        | 19    | 4·4    |
| Toronto.....                                                             | 78°0      | 1     | 25·2     | 29    | 57·4     | 40·2 | 43·6          | 79        | 97°0            | 17·5              | 3·49        | 10    | 5·3    |
| Fredericton .....                                                        | 72·8      | 2     | 16·1     | 27    | 55°0     | 32·2 | 31·4          | 55        | ...             | ...               | ·86         |       | 3·7    |
| Winnipeg.....                                                            | 78°0      | 8     | 6°0      | 24    | 48°0     | 28·1 | ...           | ...       | ...             | ...               | 1·03        | 7     | 5·6    |
| Victoria, B.C.....                                                       | 58°0      | 5     | 33·5     | 19    | 52·9     | 42·6 | ...           | 82        | ...             | ...               | 2·81        | 14    | 5·9    |
| Dawson.....                                                              | 48·5      | 5     | -2·8     | 29    | 30·2     | 18·5 | ...           | ...       | ...             | ...               | 1·84        | 14    | 7·1    |

a and 30. b and 29, 30. c and 16.

MALTA.—Mean temp. of air 66°·4, or 2°·9 below average. Mean temp. of sea 73°·0; hourly velocity of wind 10·7, or 1·9 miles above average.

MAURITIUS.—Mean temp. of air 0°·7, of dew point 1°·4, and E ·41 in. above averages. Mean hourly velocity of wind 9·3 miles, or 1·7 miles below average.

MADRAS.—Bright sunshine 180·5 hours.

KODAIKANAL.—Bright sunshine 167 hours.

COLOMBO.—Mean temp. of air 79°·9, or 0°·3 below, of dew point 1°·4 above, and E ·14 in. above, averages. Mean hourly velocity of wind 6·5 miles, prevailing direction, S.W.

HONGKONG.—Mean temp. of air 75°·9. Mean direction of wind E. by N., and mean hourly velocity 12·4 miles. Bright sunshine 201·7 hours. E 2·90 in. below 20 years' average.

ADELAIDE.—Mean temp. of air 6°·9 below, E 1·17 in. above, average. Bright sunshine 49 hours below average.

SYDNEY.—E ·65 in. below, mean temp. 4°·4, and humidity 4·9 below, averages.

WELLINGTON.—Mean temp. of air 0°·8 below, and E 1·90 in. above, averages.

AUCKLAND.—Stormy month, E 2·75 in. above average. Mean temp. much below average

TRINIDAD.—E 6·94, or ·17 in. above 40 years average.

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## THE RAINFALL OF APRIL AND OF THE FIRST FOUR MONTHS OF 1906.

APRIL has been an unusually dry month over the greater part of the British Isles, and a large part of southern England experienced an absolute drought, continued from March, throughout the first fortnight. The variations of rainfall over the country for the month just past, and for the four completed months of 1906 in the aggregate, are amply set forth in the Table on pp. 76-77, and only a few words are required to direct attention to the facts there recorded. As frequently happens in the distribution of rainfall, the north-western part of our islands was subjected to a set of conditions sharply in contrast with those experienced in the south-east. Everywhere to the north of a line drawn from Sligo Bay to a point in the middle of the south shore of the Moray Firth the rainfall of April was above the average. The general rainfall for the month in this wet area had an excess, as nearly as we can estimate it, of 28 per cent., not making it a very wet month it is true, but at least keeping April in harmony with the three months which went before in that part of the country. Over England and the south-east of Scotland and Ireland, where the deficiency of rain declared itself, the general rainfall showed a deficiency of about 43 per cent. There was a large part of England and the south of Scotland over which rather less than half the average amount of rain fell, the driest area extending from Dundee to Chichester and Torquay, on the whole filling the eastern and central parts of the island, although all along the east coast itself there was a slightly higher fall, such as might be expected from the prevalence of wind with an easterly component.

Turning from the relation of rainfall to the average to the actual amounts which fell, we find a remarkable number of returns recording less than one inch for the month. Indeed, from the shores of the North Sea to the borders of Wales, falls of one inch or more only occurred on some isolated patches of high land or in the continuation of the Pennine Chain, and falls exceeding two inches were recorded in only half a dozen isolated patches in what are normally the wettest parts of England and Wales. Fairly heavy falls, however, took place in the north-west of Scotland.

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While April has proved a dry month in most places, the fact remains that so far as 1906 has gone it still deserves to be accounted a wet year. The distribution of rainfall has varied each month, no less than the amount. A triangular strip which has missed most of the heavy falls, lies with its apex in the north-east of Ireland and widening across Scotland and England until its base borders the North Sea from Aberdeen to Hull; over this area the average has not been reached, the mean deficiency being 17 per cent. The extreme south of Ireland also seems to have received a little less than the average rainfall; but all other parts of the British Isles show a considerable excess despite the dryness of the last month. The excess is greater than 25 per cent., and rises in places to 43 per cent., in five areas, *viz.*, the north-west of Ireland, the west and north of Scotland, Wales, the south-west of England, and Norfolk and Suffolk. From the general arrangement of the areas of excessive and deficient rainfall, the tendency towards the formation of parallel belts running from north-east to south-west, to which attention was called in our January number when dealing with the rainfall of 1905, seems to continue.

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### ABSOLUTE DROUGHT IN LONDON, MARCH-APRIL, 1906.

THE following letter appeared in *The Times* of April 30th :—

SIR,—The fall of nearly a quarter of an inch of rain in the early hours of this morning has broken a period of drought which, if neither very prolonged nor very serious, is by no means usual.

What constitutes a drought in popular language I do not know; but the indefiniteness of the expression and the exaggeration of the facts which resulted led, many years ago, to the formulation of two definitions, the usefulness of which is generally acknowledged. An absolute drought is taken as a period of more than 14 consecutive days on which no rain is recorded (the smallest figure recorded in any case being '01 in.), and a partial drought is taken as a period of more than 28 consecutive days, the average rainfall of which does not exceed '01 in. per day. In the 48 complete years' record at this station there have been 53 absolute and 47 partial droughts, so that both occur on the average about once a year.

Absolute droughts occur most often in April and June, partial droughts are most frequent in May and July. On the occasion just passed the absolute drought lasted for 17 days, not a drop of rain having fallen between March 27 and April 12, both inclusive. On Good Friday the skirts of one of the thunder-showers which swept over the country north of London touched this station, and in six minutes just '01 in. of rain was recorded. But for this technical break the absolute drought would have lasted for 23 days, as it did in most parts of London in fact, and over the whole in effect. The

partial drought extended to 34 days from March 24 to April 26, both inclusive, the total rainfall in that period amounting to '34 in.

The uncertainty of weather makes it a safe rule to call no month dry until it is ended; but it is at least probable that April will be much drier than March, which was much drier than February, which in turn was much drier than January. Put roughly to the nearest fifth of an inch, the rainfalls of the first three months of 1906 in London have been respectively 4 in., 2 in., 1 in.; and it is not yet impossible that the fourth month may continue this interesting arithmetical series and be expressible as half an inch.

Your obedient servant,

HUGH ROBERT MILL.

62, Camden Square, London, N. W., April 28.

[The words "arithmetical series" in the last sentence should have been "numerical series." Mised by the adjective, a critic, zealous of the exactitude of mathematical terminology, took the trouble to inform the public that the series quoted was not an "arithmetical progression" but a "geometrical progression," which is true; though in the letter it was not called a "progression."—ED., *S.M.M.*]

## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

### HEAVY FOUR MONTHS' RAINFALL IN CHESHIRE AND NORTHUMBERLAND.

I WAS interested in the recent letter in *The Times*, describing the arithmetical sequence of your London Rainfall. Ours in Cheshire has been very different. In 30 years we have never had such a record of heavy falls for the first third of a year:—

|                   |           |
|-------------------|-----------|
| January .....     | 3·93 in.  |
| February .....    | 3·28 in.  |
| March .....       | 2·57 in.  |
| April .....       | 2·29 in.  |
| Four months ..... | 12·07 in. |

Even 1882—which gave us 41·95 in. on the whole year—only gave 9·56 in. to 30th April; and till now no year has surpassed 1903 with its 10·19 in. for the first four months.

EDWARD PEARSON.

*Parkeyside, Wilmelaw, May 1st, 1906.*



HAVING seen the letter in yesterday's *Times*, I may add that our experiences do not entirely agree with yours in London and many other places—e.g. :—

|             | Rainfall. |       | Heaviest fall. |       | Date. |       | No. of wet days. |
|-------------|-----------|-------|----------------|-------|-------|-------|------------------|
| January ... | 1·88      | ..... | ·58            | ..... | 28th  | ..... | 18               |
| February... | 1·15      | ..... | ·28            | ..... | 25th  | ..... | 13               |
| March ..... | 1·62      | ..... | ·42            | ..... | 11th  | ..... | 14               |
| April ..... | 1·55      | ..... | ·41            | ..... | 16th  | ..... | 12               |

On Sunday last (29th) we had ·38 in., mostly snow, falling between 10·45 and 3 p.m. or thereabouts, whilst on the Saturday before we had nothing. In Newcastle, I hear, it was wet on Saturday and not on Sunday. The Cheviots were all white at midday on Sunday, and the snow was lying here on the low ground as well, but it worked off the lower ground before dusk; some snow had actually accumulated in the gauge and took some little time to melt. We had no absolute or partial drought, the nearest approach being between March 25th and April 16th, 21 days, both inclusive, when we had only one small shower, ·04 in. on the 7th April; we also had ·32 in. mingled snow and rain on April 25th. I do not think I ever before experienced such a day as Sunday last so late in the season as the end of April, nor such a bitter April.

B. P. SELBY.

*Pawston, Mindrum, Northumberland, May 1st, 1906.*

## APRIL WEATHER.

THE weather of April, 1906, in this district has been remarkable for some extraordinary vagaries.

The first 17 days of the month were rainless, with the exception of the 5th, when rain fell continuously from 6 p.m. to midnight, depositing ·25 in. in the gauge. The remainder of the precipitation for the month, which chiefly occurred in the last week, amounted to 1·17 in., and brought the total to 1·42 in.

The 30th was remarkable for a hailstorm, lasting from noon to 0·30 p.m., which deposited ·38 in. of rainfall in the gauge. This amount probably failed to represent the total precipitation, as the hail being about the size of peas and very hard, no doubt to some extent bounced out of the funnel of the gauge. The hail lay on the ground to a depth of over an inch. The temperature fell in the half hour whilst the storm was in progress to the extent of 12°. Just before the storm, the dry bulb stood at 55° and the wet bulb at 50°. Directly it was over, the thermometers were again read and they were 43° and 41° respectively. The barometer, which had been quite steady for two days previously, gave the usual sudden upward movement generally noticed before thunderstorms, but no electrical phenomena were observed here.

Some low temperatures were observed in the latter part of April, which must surely be unusual for the south coast.

*Shade Minima.—April.*

|            |     |            |     |
|------------|-----|------------|-----|
| 15th ..... | 31° | 23rd ..... | 37° |
| 16th ..... | 32° | 24th ..... | 32° |
| 17th ..... | 31° | 26th ..... | 33° |
| 19th ..... | 35° | 27th ..... | 32° |
| 20th ..... | 33° | 29th ..... | 32° |

It is not to any extremely low reading that I would call attention, but to the continued persistent cold.

D. W. HORNER.

*Worthing, May 1st, 1906.*

**THE THUNDERSTORM OF MAY 8th.**

You will find the area of the big rain of Tuesday evening, May 8th, a restricted one. It is the largest single fall we have had here since September, 1880 ; July, 1890 ; October, 1893.

The thunderstorm (which lasted six hours, 5.30 to 11.30) was a Thames Valley one, probably extending from Richmond to Reading.

At Upton, from west to east, the readings run :—

|                  |                      |
|------------------|----------------------|
|                  | in.                  |
| Mr. Warren.....  | 1·91                 |
| Mr. Bentley..... | 1·96 westerly gauge. |
| do. ....         | 2·03 easterly gauge. |

At Windsor rain was very heavy. Burnham and Farnham (say 4 miles north of this) report none. Bray reported rain. Maidenhead, I think, none or not until late.

RICHARD BENTLEY.

*Upton, Slough, Bucks, May 10th, 1906.*

As the amount of rain which fell during Tuesday's thunderstorm seems to have been very variable round about London, I send you the amount that fell here—1·08 in. All of this fell between 6.35 p.m. and 7.7 p.m., a period of 32 minutes. The hailstones were large, but there were not many of them, so that I do not think the gauge lost much by out-splashing.

ERIC L. HAWKE.

*10, Frognal, Hampstead, N. W., May 10th, 1906.*

[The rain recorded at Mill Hill was ·09 in., that at Camden Square only ·01 in.—ED. *S.M.M.*]

**SNOW ON THE HILL-SIDES.**

I HAVE been much interested in the correspondence on this subject. May I be allowed to say a few words on a similar matter? It is my

fortune to reside on the southern borders of the English Lake District. The hills of this immediate neighbourhood are spurs of the great mountain masses lying further north; other spurs run down towards the sea in more or less parallel ridges, somewhat irregular in height, but all trending generally in a direction from N.N.E. to S.S.W., with valleys of varying width lying between them. Our geological formation is all of the Silurian period, being of slaty material. Some of the hills are of volcanic origin, others due to aqueous agency. For some years I resided on the westerly slope of one of these ridges, opposite to the easterly slope of another ridge, with a valley a mile or more wide intervening. During snowy periods I noted that if the fall was not great—say an inch or two was lying in the morning—by noon or soon after, if the day were sunny scarce a trace of the snow would be left on the slope opposite, while on our side very little difference in the depth of the snow could be seen, and it would often be a day or two longer before it was gone. The explanation being, as it appeared to me, simply that the easterly slope receiving all the morning sunshine and with the sun's rays acting perpendicularly, or nearly so, on it—while the westerly slope receiving scarcely any sunshine at all and that only acting at a very low angle—the snow was bound to disappear more rapidly on one side than on the other, the afternoon sun being not of much account in the winter time. If also we remember that for the same reason the soil of the easterly slope will in all probability be much warmer than that of the westerly slope, we can scarcely think the matter could be otherwise. Another little fact in this connection may also be noted—one, perhaps, that is sometimes lost sight of—viz., the *distribution* of the snowfall on these hill-sides. This varies considerably with the direction of the wind, for if the wind be blowing rather strongly and steadily in one direction during the snow-storm, the hill slopes facing the wind will have a much heavier deposit of snow than will be found on their lee sides. A specially striking example of this occurred during the present month. On the 17th inst. a stormy wind was blowing from the W.S.W. with some rather heavy showers of rain in this immediate locality but heavy snow-storms up among the hills. The following morning I set off with a friend for a walking tour among these hills and valleys. On starting we had immediately in front of us the S.W. side of Coniston Old Man and his fellows and these were all covered with a sheet of snow, but as we proceeded on our way and got to the southern and south-eastern side we found the snow gradually thinned away, till further up on the E.N.E. sides there was absolutely no snow at all on them. We stood on some high ground to the N. of the little town of Hawkeshead and a grand sight presented itself. The whole range of mountains to the N.E.—High Street, Ill Bell, Kidsty Pike and the rest—were absolutely white with snow, but turning round and looking in the opposite direction no snow at all was to be seen, just the dark purple rocks and the masses of

golden brown bracken lying amongst them ; whilst looking due N. or somewhat to the N.W. one side of the mountains could be seen covered with snow, the other side with none at all.

C. P. CHAMBERS.

*April 28th, 1906.*

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### THE CYCLONIC STUDY OF RAINFALL.

PERMIT me to thank you for the abstract you give in *Symons's Meteorological Magazine* of my paper on the distribution of precipitation in some American cyclones. Thinking that you might wish to know about those points which I neglected mentioning, I take the liberty of saying that the limit of precipitation I used was that of perceptibility, and that I used all cyclones, large and small, unless there was doubt as to whether the stations averaged were to be referred as being within their gradient or it was clear they were not to be so referred. For example : if there was one cyclone to the west of a station 800 miles from this, and another east 900 miles distant, then the data were averaged in that cyclone of these two, inside of which the station lay. If the "high" separating these two "lows" lay to the west of the station, then the east cyclone was used—or vice versa.

The crescent-shaped distribution of precipitation in the western cyclones I averaged, suggest that your opinion may be right as to the proper way of orienting the diagram with regard to the path of the cyclones. Should these crescents change to a more or less circular area, if the diagram were oriented in that way, it would be pretty strong evidence that yours would be the proper way. I wish I could try this, but I can hardly hope to take the necessary time for it.

I hope others will see the many applications the method is adapted to in obtaining a more exact knowledge of the cyclone. Perhaps the distribution of the rainfall may yet be such as our text-books would have it : the maximum being to the south-east. If so, then there must be a diurnal rotation of the area of greatest precipitation, for it is certainly not in that quarter for the morning hour.

J. A. UDDEN.

*Rock Island, Ills., April 9th, 1906.*

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### THE GREEN FLASH.

It should be noted that the green or any other coloured ray is not always seen even when the sun sets at sea on a perfectly clear horizon.

D. WILSON-BARKER.

*H.M.S. Worcester, off Greenhithe, Kent,  
May 5th, 1906.*

### THE GREEN FLASH IN FICTION.

DR. RAMBAUT's able articles on the Green Flash on the Horizon must have reminded many readers of the periodical recurrence of interest in this curiously fascinating phenomenon. It is by no means easily seen, for the opportunity of a clear evening and an unobstructed sea-horizon occurs but rarely to the average man. We have seen it only a dozen times in twenty years, though these years afforded many thousand miles of ocean travel. We saw it twice in the Baltic, once in the North Atlantic, once off the west coast of Scotland, twice in the Bay of Biscay, and four or five times in the Indian Ocean, on one occasion on a land horizon rising a few minutes of arc above the sea. The gradual change from a yellowish to a bluish green was apparent on most of these occasions.

In the early eighties M. Jules Verne made the phenomenon the text of a novel, "*Le Rayon Vert*," (The Green Ray), and it seems not without interest to recall this instance, solitary, so far as we know, of a meteorological phenomenon inspiring a work of creative fancy. The book is peculiar in more ways than one. It partakes of the nature of a guide-book to a tour on the west coast of Scotland and abounds in delightful touches, showing how difficult it is for a stranger to appreciate the full value of local colour.

The story is simple. Two old gentlemen, who in many ways are charmingly simple also, live at Helensburgh with their niece, Helena Campbell, to whom they are devoted, and they have decided that it would be a delightful arrangement for Helena to marry a young scientific man rejoicing in the typical Scottish name of Aristobulus Ursiclos. They broach the subject to the young lady, who laughingly declares that she will make up her mind to marry no one until she has seen—the Green Ray. The uncles had never heard of such a thing, but the niece (at 5 p.m. in Helensburgh, in 1881,) produces the *Morning Post* of that day with this article, which in default of turning up the paper in question we re-translate from the French:—

"Have you ever observed the sun when it is setting beneath a sea-horizon? Yes! without doubt. Have you followed it to the moment when, the upper part of the disk just touching the line of water, it is in the act of disappearing? It is very probable that you have. But have you noticed the phenomenon which appears at the precise moment when the radiant orb shoots forth its last ray if the sky is free from haze and perfect in its purity? Perhaps not. Ah! well, the first time you find the occasion to make this observation—and it presents itself but rarely—it will not be a red ray that will strike your eye, as one might expect; it will be a "green" ray, but a marvellous green, a green that no painter could obtain on his palette, a green of which even Nature itself has never reproduced the shade, neither in the varied tints of vegetation nor in the colours of the most limpid seas! If there is a green in Paradise it can only be that green, which is, without doubt, the very green of Hope!"

The niece, however, did not say, though apparently she knew, that an old Highland legend affirmed that this ray conferred on whoever saw it the magic power of making it impossible to deceive oneself in matters of sentiment, by destroying all illusions and lies, and of seeing clearly into one's own heart and into the hearts of others. If any members of the Society for Psychical Research accompanied the British Association on its African cruise, they might perhaps supplement the physical treatise by developing this attractive thesis. The uncles merely responded, "Let us go and see the green ray"; and next morning they left Helensburgh and betook themselves *via* Crinan to Oban, a route which the uncles did not like. "Au diable ce Rayon-Vert!" said one, "And those who invented it," replied the other; but they went. At Crinan they heard Gaelic spoken, "a language often incomprehensible even to the English." That night the sun set in a cloudless sky, but the steamer at the moment was performing heroic evolutions in the Gulf of Corryvreckan rescuing a small boat which had got caught in the whirlpool, and all eyes were turned on the handsome young man who was rescued at the moment the sun went down. It was Olivier Sinclair, who prevented the sight from being seen: an artist, a poet, a traveller whose sketches of foreign travel were accepted even by the famous *Edinburgh Review*. At Oban Aristobulus Ursiclos joined the party. He brought the melancholy news that "the depression of Swinemunde was moving northwards and deepening considerably. Its centre was at Stockholm to-day and there the barometer had fallen one inch, or, to employ the decimal system used by men of science, twenty-five millimeters." Consequently, the fine weather was not to last. Moreover, at Oban there was no sea-horizon, and excursions had to be made each evening to a neighbouring island to see the sun set. After a fortnight's waiting, an evening arrived when the sun had half set on an absolutely clear horizon but a sailing-boat glided up and blotted out the critical moment of total immersion. Aristobulus Ursiclos was on board.

The party proceeded to Iona, and in waiting for a clear sky Ursiclos announced his intention of writing a memoir on the green ray, which he held derived its colour either from the sea-water or from the contrast with the red of the sun. Olivier Sinclair recommended him also to prepare memoirs on two other important oceanographical and meteorological problems, to wit, "On the influence of the tails of fishes on the waves of the sea," and "On the influence of musical instruments on the formation of storms." Again a clear evening came, and as the last little segment of the solar disk was on the point of vanishing, bang went two shots and a cloud of frightened sea-birds rose like a veil blotting out the view. Aristobulus Ursiclos had fired the shots.

This was too much even for the uncles, who instantly hired a charming yawl and all the good characters set sail for Staffa, marooning the mephistophelian Aristobulus on Iona. At length,

after amazing adventures in Fingal's Cave during a storm, another cloudless evening was about to pass into night; the uncles, the niece, Olivier Sinclair, Partridge, the gillie, and Betsy, the maid, were all assembled. The sun dipped. "The green ray! the green ray!" cried the uncles, Partridge and Betsy in one voice . . . . but Helena had only seen the black ray from Olivier's eyes, and Olivier had only seen the blue ray from Helena's, and they all lived happy ever after! Olivier ultimately painted a magnificent picture of the green ray he had never seen.

Such is the gist of 270 very entertaining pages.

Although it is not fiction, we may quote here a question set recently in the examination in Astronomy for the Science degree of the University of which Aristobulus Ursiclos is alleged to have been a distinguished graduate. It runs:—

Being given that the last red ray from the sun disappears when its centre is at a distance  $a$  below the horizon, but that if the horizon be clear the blue rays may remain visible until it has sunk to a distance  $a+da$ , where  $da$  is a small quantity whose square may be neglected, show that in latitude  $\frac{\pi}{2}-\omega-a-da$  (where  $\omega$  is the obliquity of the ecliptic) on the night of the summer solstice the blue rays may persist after the red have disappeared for a time  $h$  given by the expression

$$2 \sin^2 \frac{h}{2} = \frac{\cos a \, da}{\cos \omega \sin (\omega + a)}$$

## DR. W. N. SHAW ON ATMOSPHERIC CIRCULATION.

ON May 1st, at the University of London, Dr. W. N. Shaw delivered the first of his series of four lectures on Meteorology, dealing mainly with the broader features of the general circulation of the atmosphere. By way of introduction he pointed out that a period of stagnation seemed to have followed the rapid development of the cyclonic theory as the basis of weather forecasting, and that the processes now in use differed little from those of a quarter of a century ago. In other directions, however, the progress of meteorological study has been great. The investigator of to-day has not as formerly to work on a more or less conjectural or speculative basis, since during the last 50 years a wealth of observational matter has been gradually and patiently accumulated, and now lies ready to the hand of the student. It is, therefore, possible and most desirable that the subject should be attacked afresh from the wider point of view.

Turning to the immediate subject of the lecture, it was remarked that the circulation of the atmosphere must be looked upon as a single, though complicated, process taking place over the globe as a whole. Discussion confined to any portion of the Earth, as for instance the British Isles, would, therefore, be inadequate.

Owing to the thinness of the atmospheric layer in comparison with the area over which it is spread, the intensity of the horizontal movement is far greater than that of the vertical, and this horizontal action is brought about by a variety of influences. Primarily, disturbances of thermal equilibrium cause disturbances of dynamic equilibrium, and thus the movements of the atmosphere may be looked upon as due to the variable distribution of heat. Such disturbing influences are the movements of the sun, the irregular distribution of land and water, the heat liberated by the condensation of water vapour, actual alterations in the heat of the sun itself, and above all the rotation of the Earth. There are, however, recognisable underlying regularities which are not entirely obscured.

The phenomenon of the diurnal variation of the barometer was excellently illustrated by slides showing a series of barograms produced on board H.M.S. *Leander*, in various parts of the globe, and it was observed that though this was frequently obscured in temperate regions, by analysing the average values from a number of curves, it could be shown that there existed a component oscillation with double maxima at 10 a.m. and 10 p.m., and the corresponding minima at 4 a.m. and 4 p.m., local time, all over the Earth.

Maps of prevailing winds give a good general impression of the surface circulation of the air, and Dr. Shaw was able to show that the circulation to be inferred from the mean isobars, by the application of Buys Ballot's law, corresponds very satisfactorily with the observed winds. Maps of average pressure, therefore, form the basis of all considerations as to surface conditions.

Another aspect of Buys Ballot's law may be called the numerical aspect. The actual movement of air compared with the disposition of force due to barometric gradient shows that the movement takes place nearly at right angles to the direction of the applied force, namely, nearly parallel to the isobars, with some incurving towards the centres of depressions, and some outcurving away from the centres of anti-cyclonic systems. The maintenance of a state of motion at right angles to the direction of the acting force is familiar to us in various cases of rotation, and in the case of the wind it can be accounted for by the rotation of the Earth. Motion in the revolving Earth without any pressure difference would imply acceleration to the right (in the Northern hemisphere), and thus to keep air moving steadily it requires pressure always to push it towards the left and counteract the effect of the Earth's rotation. It is possible, being given the latitude, to calculate from the velocity of the wind what gradient would be necessary in order to keep air moving along an isobar; or, in other words, to analyse the conditions under which air currents are guided in any particular direction. Several interesting slides were exhibited, showing the distribution of pressure and the calculated paths of air on February 10th-11th, 1899, and from June 13th-20th, 1883.

With regard to the movements of the upper air, one method of



studying them is by observing the movements of dust on such occasions as the great Krakatoa eruption of 1883, and a second by observations of the upper clouds. A number of slides were shown with graphic representations of the average direction of movements of the upper clouds at various stations in India and Europe, and Dr. Shaw went on to say that it is possible to calculate the distribution of the upper air from the known pressure at the surface, by deducting the weight of the lower strata, deduced from pressure, temperature and humidity observations. This was done some years ago by M. Teisserenc de Bort, who drew a map of the pressure distribution at 4000 metres altitude. The results accord well with those deduced from cloud observations.

Several photographs of kites and balloons for investigation of the upper air were also exhibited.

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### ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, April 18th, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. Alfred Hands read a paper on "Some so-called Vagaries of Lightning reproduced experimentally." He said that lightning is an electric discharge, and as such it should act in accordance with the laws that are known to govern discharges. We have, doubtless, much to learn yet as regards electricity, but even though fresh facts and laws may be discovered they can scarcely be in direct opposition to those already known, and, therefore, if an occurrence does not appear to accord with our knowledge, we should try and fathom the mystery and not dismiss it as a vagary. The author, in the course of an extended investigation into the effects of lightning, has come across many cases that have been called vagaries, but which on a close inspection have proved to be extraordinary only in the erroneous way in which they were described, and had they been correctly reported would have appeared perfectly consistent with ideas previously held—in fact, could have been foretold in every case if the conditions that led to those effects had been known before the events occurred.

Mr. Hands reproduced, experimentally, several so-called vagaries of lightning, showing by means of skeleton models the conditions under which they occurred, and by a single discharge producing effects which would be most perplexing if the arrangement of the hidden links in the alternative paths of conduction were not known.

Mr. Baldwin Latham said that he had frequently heard of lightning flashes making their way down chimney stacks, passing through the engine house, and thence seeking the earth, instead of taking a direct path from the top of the chimney shaft to the earth. He thought it would be desirable for those wishing to put up lightning

conductors to seek the best possible advice, so as to avoid the mistakes to which attention had been drawn in the paper.

Mr. J. E. Clark referred to a lightning flash that had fused a gas pipe in a narrow alley close to York Minster.

Mr. W. Marriott said that the Royal Meteorological Society had instituted a number of investigations on the subject, and had been the means of organizing the Lightning Rod Conference in 1878. The recommendations of that Conference for the protection of buildings from lightning still held good.

Mr. A. Hands said that a good earth connection for the lightning conductor was very necessary, but it was not everything, and care should be taken that rival conductors in the form of gas and water pipes were not set up and the discharge divided.

The President remarked that the early Egyptians took precautions to guard against damage by lightning, and the roof of Solomon's Temple was studded with metal points for the same purpose.

Miss C. O. Stevens read a paper on "The Value of a projected image of the Sun for Meteorological Study." She pointed out that by this method it had been ascertained that where the direction of movement of the atmosphere is tangential to the limit of the sun, the phenomenon of "boiling" displays a coursing or rippling character, and that where it is perpendicular to the limb of the sun the character of the movements of distortion is that of springing in and out of the area of the sun's image. Both these elements of movement are continuous, even in the absence of all visible cloud, and it is possible not only to detect but also to distinguish between overlying invisible atmospheric strata.

Mr. R. Inwards, Mr. W. H. Dines, Mr. H. Mellish, Mr. J. E. Clark, and the President, took part in the discussion on the paper, and Miss Stevens replied.

The following were elected Fellows of the Society:—Mr. K. N. Banaji, Mr. R. Cross, Miss E. Halsey, Mr. L. M. Ting, and Rev. F. W. Walter.

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## REVIEWS.

*Report of the Meteorological Council for the Year ending 31st of March, 1905, to the President and Council of the Royal Society. Presented to both Houses of Parliament by Command of His Majesty. London: 1906. Printed for His Majesty's Stationery Office. [Cd. 2829]. Size 9½ x 6. Pp. 228. Price 1s. 5d.*

THE last report of the anomalous body which controlled the Weather Service of the United Kingdom up to March 31st, 1905, has appeared rather more than a year after the Council in question has been superseded. The judgment passed upon the organization of the Meteorological Council by the Treasury Committee which sat upon it in 1902 and suggested various measures of reconstruction which have now in part been given effect to, will be remembered by our readers. Fortunately the men who carried on the work of the

Meteorological Office have always been better than the system under which they acted, and this has never been more true than in the last year of the old order of things.

The usual report of work done requires no special comment except that more time has been devoted to the purely scientific aspects of meteorology in the direction of experiment and special observations than in earlier years. The most interesting section of the Report is Appendix II., entitled "An account of the work of the Meteorological Office during the past fifty years." This is the official history of the relations of the British Government with meteorology. In 1855 the Government established a department of the Board of Trade under the charge of Admiral FitzRoy to co-operate in the international study of the meteorology of the oceans initiated by Lieutenant Maury of the United States Navy. The Government grant for this work (partly included in the Board of Trade, partly in the Admiralty votes) amounted to £4200. Co-operation with Kew Observatory in testing instruments was carried out from the first. In 1860, telegraphic weather reports were instituted by Admiral FitzRoy and storm warnings based upon them were issued. Weather forecasts also were prepared and published in the newspapers; but this work, which came to absorb most of the grant, it must be borne in mind, was superimposed upon the original functions of the Meteorological Office, which were international and world-wide. Admiral FitzRoy died in 1865, and a Committee of the Royal Society was appointed to inquire into the whole matter of the work of the Office. This Committee advised the stoppage of weather forecasts, the improvement of storm warnings, the continuation of marine observations for a time, and above all the establishment of "a full, constant and accurate system of showing changes of weather in the British Isles." As a result of this, a grant of £10,000 per annum was secured and the Royal Society appointed a Committee to administer the grant. The Committee, which included gentlemen well known in several walks of science, some of whom had paid special attention to meteorology, appointed Mr. R. H. Scott as Director of the Office, Captain Toynbee as Marine Superintendent, and Mr. Balfour Stewart as Secretary and Director of the Kew Observatory. Under this Committee the land meteorology of the British Isles was greatly extended and the system of daily weather charts and forecasts elaborated. This order of things terminated with the Report of the Treasury Committee of 1874 (*see this Magazine*, Vol. 12 (1877), pp. 17, 33, 97, for much interesting matter supplemental to the official narrative under notice), and the institution of the Meteorological Council of the Royal Society, a body whose constitution has been fully discussed in these pages (*see this Magazine*, Vol. 39 (1904), p. 102).

The funds at the disposal of the Council were increased, and under the chairmanship of Professor Henry Smith and then of Sir Richard Strachey and the secretaryship of Dr. R. H. Scott and later of Dr. W. N. Shaw, the Council proceeded to do much valuable work,

the main outlines of which are sketched in this history. The Weekly Weather Report was one of the first results of this reorganization and one which has proved singularly successful. The variation in the number of First Order Stations, or completely equipped meteorological observatories, is duly noted, and the fact that the Council yielded to external pressure and revoked the death sentence on Falmouth Observatory makes one regret that a little more pressure was not applied in the case of Fort William. The record altogether is one of solid, steady and increasing work, and we look forward with confidence to the new organization, which has been in force for more than a year, showing still greater progress. There are several matters waiting for reform in the future; amongst others, the hardship which the more experienced members of the staff labour under in the absence of any proper system of pensions, or of reasonable prospects of promotion to the higher posts.

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*Modern Lightning Conductors. An illustrated supplement to the Report of the Lightning Research Committee of 1905, with notes as to the Methods of Protection and Specifications.* By KILLINGWORTH HEDGES. London: Crosby, Lockwood & Son, 1905. Size 10 x 6. Pp. viii. + 120.

WE have not been so fortunate as to see the Report of the Lightning Research Committee, of which Mr. Hedges was the honorary secretary, nor does the present volume state where that Report may be obtained. The Committee was organised jointly by the Royal Institution of British Architects and the Surveyors' Institution, so that its objects were of a thoroughly practical nature, and the subject is certainly one well deserving of attention. It is probably our ignorance of the Report that makes Mr. Hedges's book appear to us to be confused in its arrangement and difficult to follow in its conclusions. It is sometimes hard to tell whether the author is giving the opinions of the Committee or his own comments upon them, and some of the chapters read like a random pile of newspaper cuttings bearing on lightning in fact and fancy. The letter-press would be improved by revision, and some of the historical statements might be verified. We did not know, for instance, that Benjamin Franklin had been knighted (p. 105).

Chapter III. gives a summary of the suggestions and recommendations of the Lightning Research Committee, and so far as these differ from the findings of the Lightning Rod Conference arranged by the Royal Meteorological Society in 1878 they are likely to prove disquieting to those responsible for the protection of buildings. The instances quoted by the author of serious damage caused to "protected" buildings by lightning and the apparent scepticism of the Lightning Research Committee as to the possibility of securing complete protection, might almost induce some people to run the risk of having no lightning conductor at all rather than incur that of installing a possibly insufficient system.

## TEMPERATURE FOR APRIL, 1906.

| STATION.                           | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |        |      |        | No. of Nights<br>at or below 32° |        |
|------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|--------|------|--------|----------------------------------|--------|
|                                    |                      |            |                      |                                | Max.         |        | Min. |        | Shade.                           | Grass. |
|                                    |                      |            |                      |                                | °            | Date.  | °    | Date.  |                                  |        |
| Camden Square.....                 | London.....          | 51 32      | 0 8                  | 111                            | 73·0         | 12     | 30·1 | 15 †   | 5                                | 17     |
| Tenterden.....                     | Kent.....            | 51 4       | 0 41                 | 190                            | 72·5         | 11     | 28·0 | 24     | 9                                | 18     |
| West Dean.....                     | Hampshire.....       | ...        | ...                  | 137                            | 67·0         | 12     | 24·0 | 16     | 13                               | 28     |
| Hartley Wintney.....               | ".....               | 51 18      | 0 53                 | 222                            | 73·0         | 12     | 24·0 | 15, 16 | 9                                | 16     |
| Hitchin.....                       | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | 70·0         | 11, 12 | 26·0 | 14     | 14                               | ...    |
| Winslow (Addington).....           | Buckinghamsh. ....   | 51 58      | 0 53                 | 309                            | 72·0         | 12     | 25·0 | 20     | 9                                | 21     |
| Bury St. Edmunds (Westley).....    | Suffolk.....         | 52 15      | 0 40                 | 226                            | 73·0         | 11     | 27·0 | 20     | 14                               | ...    |
| Brundall.....                      | Norfolk.....         | 52 37      | 1 26                 | 66                             | ...          | ...    | ...  | ...    | ...                              | ...    |
| Winterbourne Steepleton.....       | Dorset.....          | 50 42      | 2 31                 | 316                            | 64·8         | 12     | 25·0 | 14, 24 | 10                               | 17     |
| Torquay (Cary Green).....          | Devon.....           | 50 28      | 3 32                 | 12                             | 64·8         | 13     | 33·9 | 3      | 0                                | 11     |
| Polapit Tamar [Launceston].....    | ".....               | 50 40      | 4 22                 | 315                            | 66·9         | 11     | 26·9 | 16     | 10                               | 12     |
| Bath.....                          | Somerset.....        | 51 23      | 2 21                 | 67                             | 68·5         | 12     | 26·0 | 27     | 7                                | ...    |
| Stroud (Upfield).....              | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 66·0         | 13     | 32·0 | 30     | 1                                | ...    |
| Church Stretton (Wooltaston).....  | Shropshire.....      | 52 35      | 2 48                 | 800                            | 69·5         | 13     | 23·0 | 19     | 17                               | ...    |
| Bromsgrove (Stoke Newington).....  | Worcestershire.....  | 52 19      | 2 4                  | 225                            | 68·0         | 12     | 22·0 | 14, 26 | 12                               | ...    |
| Boston.....                        | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 70·0         | 12     | 26·0 | 20     | 12                               | ...    |
| Workshop (Hodsock Priory).....     | Nottinghamshire..... | 52 22      | 1 5                  | 56                             | 70·1         | 13     | 23·5 | 10     | 17                               | 27     |
| Derby (Midland Railway).....       | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 73·0         | 11     | 29·0 | 14, 26 | 9                                | ...    |
| Bolton (Queen's Park).....         | Lancashire.....      | 53 35      | 2 28                 | 390                            | 63·6         | 12     | 29·5 | 27     | 4                                | 19     |
| Wetherby (Ribston Hall).....       | Yorkshire, W.R. .... | 53 59      | 1 24                 | 130                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Arnccliffe Vicarage.....           | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Hull (Pearson Park).....           | "..... E.R. ....     | 53 45      | 0 20                 | 6                              | 69·0         | 13     | 29·0 | 3 ‡    | 11                               | 24     |
| Newcastle (Town Moor).....         | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Borrowdale (Seathwaite).....       | Cumberland.....      | 54 30      | 3 10                 | 423                            | 69·3         | 11     | 30·1 | 18     | 5                                | ...    |
| Cardiff (Ely).....                 | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...    | ...  | ...    | ...                              | ...    |
| Haverfordwest (High Street).....   | Pembrokeshire.....   | 51 48      | 4 58                 | 95                             | 67·6         | 12     | 26·7 | 16     | 6                                | 21     |
| Aberystwyth (Gogerddan).....       | Cardigan.....        | 52 26      | 4 1                  | 83                             | 71·0         | 12     | 21·0 | 18     | 19                               | ...    |
| Llandudno.....                     | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 62·0         | 4      | 32·5 | 27     | 0                                | ...    |
| Cargen [Dumfries].....             | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 69·0         | 12     | 27·0 | 3, 19  | 10                               | ...    |
| Lilliesleaf (Riddell House).....   | Roxburgh.....        | 55 31      | 2 46                 | 550                            | 65·0         | 12     | 23·0 | 2      | 20                               | 27     |
| Edinburgh (Royal Observatory)..... | Midlothian.....      | 55 55      | 3 11                 | 442                            | 65·8         | 10     | 28·5 | 19     | 4                                | 16     |
| Colmonell (Clachant).....          | Ayr.....             | 55 8       | 4 54                 | 140                            | 63·0         | 12     | 23·0 | 18     | 14                               | ...    |
| Glasgow (Queen's Park).....        | Renfrew.....         | 55 53      | 4 18                 | 144                            | 67·0         | 11     | 27·0 | 18     | 10                               | 27     |
| Tighnabruaich.....                 | Argyll.....          | 55 55      | 5 14                 | 50                             | 56·0         | 7      | 28·0 | 18     | 17                               | 19     |
| Mull (Quinish).....                | ".....               | 56 36      | 6 13                 | 35                             | ...          | ...    | ...  | ...    | ...                              | ...    |
| Dundee (Eastern Necropolis).....   | Forfar.....          | 56 28      | 2 57                 | 199                            | 63·2         | 13     | 27·0 | 19     | 13                               | ...    |
| Braemar.....                       | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...    | ...  | ...    | ...                              | ...    |
| Aberdeen (Cranford).....           | ".....               | 57 8       | 2 7                  | 120                            | 61·0         | 9, 10  | 25·0 | 23, 29 | 18                               | ...    |
| Cawdor (Budgate).....              | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Invergarry.....                    | E. Inverness.....    | 57 4       | 4 47                 | 130?                           | ...          | ...    | ...  | ...    | ...                              | ...    |
| Loch Torridon (Bendamph).....      | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...    | ...  | ...    | ...                              | ...    |
| Dunrobin Castle.....               | Sutherland.....      | 57 59      | 3 56                 | 14                             | 60·0         | 9      | 29·5 | 24     | ...                              | 7      |
| Castletown.....                    | Caithness.....       | 58 35      | 3 23                 | 100                            | 64·0         | 12     | 29·0 | 17, 19 | 3                                | 22     |
| Killarney (District Asylum).....   | Kerry.....           | 52 4       | 9 31                 | 178                            | 67·0         | 13     | 28·0 | 15, 19 | ...                              | ...    |
| Waterford (Brook Lodge).....       | Waterford.....       | 52 15      | 7 7                  | 104                            | 63·0         | 11     | 29·0 | 15     | 7                                | ...    |
| Broadford (Hurdlestown).....       | Clare.....           | 52 48      | 8 38                 | 167                            | 63·0         | 12     | 28·0 | 13 §   | 12                               | ...    |
| Carlou (Browne's Hill).....        | Carlow.....          | 52 50      | 6 53                 | 291                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Dublin (Fitz William Square).....  | Dublin.....          | 53 21      | 6 14                 | 54                             | 63·5         | 12     | 32·0 | 19     | 1                                | 16     |
| Ballinasloe.....                   | Galway.....          | 53 20      | 8 15                 | 160                            | 65·5         | 11     | 22·0 | 3      | 20                               | ...    |
| Clifden (Kylemore House).....      | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Crossmolina (Ennisacoe).....       | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...    | ...  | ...    | ...                              | ...    |
| Seaforde.....                      | Down.....            | 54 19      | 5 50                 | 180                            | 63·0         | 12     | 30·0 | 9      | 7                                | 18     |
| Londonderry (Creggan Res.).....    | Londonderry.....     | 54 59      | 7 19                 | 320                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Omagh (Edenfel).....               | Tyrone.....          | 54 36      | 7 18                 | 280                            | 66·0         | 10, 11 | 27·0 | 18     | 6                                | 17     |

† and 20, 26.

‡ and 20, 25, 27.

§ and 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31.

## RAINFALL FOR APRIL, 1906.

| RAINFALL OF MONTH.        |                  |                             |                  |                      |       |                   | RAINFALL FROM JAN. 1.        |                  |                               |                  | Mean Annual<br>1870-<br>1899. | STATION.           |
|---------------------------|------------------|-----------------------------|------------------|----------------------|-------|-------------------|------------------------------|------------------|-------------------------------|------------------|-------------------------------|--------------------|
| Ver.<br>70-99.<br><br>in. | 1906.<br><br>in. | Diff.<br>from<br>Av.<br>in. | o/o<br>of<br>Av. | Max. in<br>24 hours. |       | No.<br>of<br>Days | Aver.<br>1870-99.<br><br>in. | 1906.<br><br>in. | Diff.<br>from<br>Aver.<br>in. | o/o<br>of<br>Av. |                               |                    |
|                           |                  |                             |                  | in.                  | Date. |                   |                              |                  |                               |                  |                               |                    |
| 69                        | 51               | -1.18                       | 30               | 22                   | 27    | 10                | 6.82                         | 7.50             | + .68                         | 110              | 25.16                         | Camden Square      |
| 77                        | 1.44             | - .33                       | 81               | 45                   | 18    | 9                 | 7.87                         | 9.07             | +1.20                         | 115              | 28.36                         | Tenterden          |
| 99                        | 98               | -1.01                       | 49               | 38                   | 5     | 7                 | 8.73                         | 11.53            | +2.80                         | 132              | 29.93                         | West Dean          |
| 69                        | 64               | -1.05                       | 38               | 15                   | 27+   | 7                 | 7.91                         | 8.43             | + .52                         | 107              | 27.10                         | Hartley Wintney    |
| 62                        | 66               | - .96                       | 41               | 19                   | 27    | 9                 | 6.50                         | 7.66             | +1.16                         | 118              | 24.66                         | Hitchin            |
| 83                        | 84               | - .99                       | 46               | 21                   | 13    | 10                | 7.23                         | 7.90             | + .67                         | 109              | 26.75                         | Addington          |
| 54                        | 85               | - .69                       | 55               | 24                   | 27    | 13                | 6.43                         | 9.00             | +2.57                         | 140              | 25.39                         | Westley            |
| 68                        | 70               | - .98                       | 42               | 24                   | 27    | 13                | 6.49                         | 9.38             | +2.89                         | 145              | 25.40                         | Brundall           |
| 60                        | 1.14             | -1.46                       | 44               | 43                   | 24    | 8                 | 12.02                        | 15.74            | +3.72                         | 131              | 39.00                         | Winterbourne Stptn |
| 45                        | 85               | -1.60                       | 35               | 44                   | 24    | 10                | 10.96                        | 11.87            | + .91                         | 108              | 35.00                         | Torquay            |
| 23                        | 1.46             | - .77                       | 65               | 42                   | 24    | 11                | 11.35                        | 16.28            | +4.93                         | 143              | 38.85                         | Polapit Tamar      |
| 05                        | 1.24             | - .81                       | 60               | 30                   | 24    | 11                | 8.63                         | 9.28             | + .65                         | 108              | 30.75                         | Bath               |
| 05                        | 81               | -1.24                       | 40               | 16                   | 5     | 11                | 8.50                         | 8.86             | + .36                         | 104              | 29.85                         | Stroud             |
| 14                        | 1.27             | - .87                       | 59               | 32                   | 29    | 12                | 9.23                         | 9.48             | + .25                         | 103              | 33.04                         | Woolstaston        |
| 66                        | 1.09             | - .57                       | 66               | 35                   | 26    | 11                | 6.56                         | 6.96             | + .40                         | 106              | 24.50                         | Bromsgrove         |
| 59                        | 58               | -1.01                       | 36               | 30                   | 27    | 7                 | 6.09                         | 7.24             | +1.15                         | 119              | 23.30                         | Boston             |
| 69                        | 62               | -1.07                       | 37               | 17                   | 22    | 12                | 6.56                         | 6.77             | + .21                         | 103              | 24.70                         | Hodsock Priory     |
| 72                        | 80               | -1.12                       | 35               | 22                   | 23    | 10                | 6.82                         | 7.96             | +1.14                         | 117              | 26.18                         | Derby              |
| 15                        | 2.43             | ...                         | ...              | 53                   | 27    | 14                | ...                          | 16.77            | ...                           | ...              | 42.43                         | Bolton             |
| 98                        | 66               | -1.32                       | 33               | 20                   | 22    | 8                 | 7.35                         | 8.19             | + .84                         | 111              | 26.96                         | Ribston Hall       |
| 32                        | 2.17             | -1.15                       | 65               | 44                   | 28    | 14                | 19.42                        | 24.19            | +4.77                         | 124              | 60.96                         | Arncliffe Vic.     |
| 72                        | 87               | - .85                       | 51               | 25                   | 28    | 12                | 7.17                         | 6.73             | - .44                         | 94               | 27.02                         | Hull               |
| 79                        | 1.57             | - .22                       | 88               | 82                   | 29    | 14                | 7.43                         | 6.28             | -1.15                         | 85               | 27.99                         | Newcastle          |
| 27                        | 4.09             | -2.18                       | 65               | 1.01                 | 27    | 14                | 43.13                        | 42.74            | - .39                         | 99               | 132.68                        | Seathwaite         |
| 34                        | 1.38             | - .96                       | 59               | 55                   | 24    | 14                | 12.11                        | 16.19            | +4.08                         | 134              | 42.81                         | Cardiff            |
| 67                        | 1.16             | -1.51                       | 43               | 29                   | 27    | 11                | 14.53                        | 15.53            | +1.00                         | 107              | 47.88                         | Haverfordwest      |
| 39                        | 1.85             | - .54                       | 77               | 65                   | 27    | 14                | 12.22                        | 17.05            | +4.83                         | 140              | 45.41                         | Gogerdan           |
| 82                        | 1.10             | - .72                       | 60               | 28                   | 27    | 10                | 8.33                         | 11.07            | +2.74                         | 133              | 30.98                         | Llandudno          |
| 30                        | 1.04             | -1.26                       | 45               | 46                   | 21    | 9                 | 13.47                        | 10.90            | -2.57                         | 81               | 43.43                         | Cargen             |
| 96                        | 92               | -1.04                       | 47               | 32                   | 21    | 13                | 9.37                         | 6.94             | -2.43                         | 74               | 33.04                         | Riddell House      |
| ...                       | 81               | ...                         | ...              | 42                   | 16    | 7                 | ...                          | 6.90             | ...                           | ...              | ...                           | Edinburgh          |
| 25                        | 1.81             | - .44                       | 80               | 58                   | 20    | 11                | 13.62                        | 12.16            | -1.46                         | 89               | 44.85                         | Colmonell          |
| 77                        | 1.23             | - .54                       | 70               | 50                   | 20    | 12                | 9.88                         | 12.37            | +2.49                         | 125              | 35.80                         | Glasgow            |
| 89                        | 3.27             | + .38                       | 113              | 47                   | 27    | 17                | 17.68                        | 22.01            | +4.33                         | 125              | 57.90                         | Tighnabruaich      |
| 80                        | 2.95             | + .15                       | 105              | 40                   | 27    | 20                | 17.38                        | 17.09            | - .29                         | 98               | 57.53                         | Quinish            |
| 94                        | 95               | - .99                       | 49               | 45                   | 16    | 9                 | 8.06                         | 4.75             | -3.31                         | 59               | 28.95                         | Dundee             |
| 18                        | 1.73             | - .45                       | 79               | ...                  | ...   | ...               | 10.21                        | 11.19            | + .98                         | 110              | 36.07                         | Braemar            |
| 22                        | 1.55             | - .67                       | 70               | 50                   | 16    | 10                | 9.40                         | 7.84             | -1.56                         | 83               | 33.01                         | Aberdeen           |
| 49                        | 2.06             | + .57                       | 138              | 46                   | 16    | 12                | 7.65                         | 9.92             | +2.27                         | 130              | 29.37                         | Cawdor             |
| 68                        | 2.87             | + .19                       | 107              | 65                   | 20    | 7                 | 19.03                        | 21.12            | +2.09                         | 111              | 56.00                         | Invergarry         |
| 31                        | 6.44             | +2.13                       | 149              | 1.20                 | 16    | 20                | 26.21                        | 36.16            | +9.95                         | 138              | 86.50                         | Bendamp            |
| 81                        | 2.18             | + .37                       | 120              | 35                   | 21    | 12                | 9.29                         | 13.27            | +3.98                         | 143              | 31.60                         | Dunrobin Castle    |
| ...                       | 2.34             | ...                         | ...              | 40                   | 25    | 15                | ...                          | 13.89            | ...                           | ...              | ...                           | Castletown         |
| 71                        | 2.34             | -1.37                       | 63               | 41                   | 29    | 15                | 19.75                        | 15.84            | +3.91                         | 80               | 58.11                         | Killarney          |
| 56                        | 1.34             | -1.22                       | 52               | 49                   | 4     | 9                 | 12.47                        | 11.70            | - .77                         | 94               | 39.30                         | Waterford          |
| 17                        | 1.41             | - .76                       | 65               | 44                   | 4     | 17                | 9.51                         | 11.90            | +2.39                         | 125              | 33.47                         | Hurdlestown        |
| 34                        | 1.43             | - .91                       | 61               | 51                   | 5     | 11                | 10.36                        | 10.47            | + .11                         | 101              | 34.44                         | Carlow             |
| 00                        | 1.83             | - .17                       | 92               | 61                   | 29    | 18                | 7.99                         | 9.12             | +1.13                         | 114              | 27.75                         | Dublin             |
| 32                        | 1.58             | - .74                       | 68               | 41                   | 4     | 20                | 10.74                        | 12.90            | +2.16                         | 120              | 37.04                         | Ballinasloe        |
| 74                        | 4.34             | - .40                       | 92               | 95                   | 4     | 17                | 24.35                        | 24.93            | + .58                         | 102              | 80.23                         | Kylemore House     |
| 90                        | 3.48             | + .58                       | 120              | 84                   | 4     | 20                | 15.86                        | 18.93            | +3.07                         | 119              | 50.50                         | Ennisce            |
| 59                        | 2.09             | - .50                       | 81               | 67                   | 24    | 17                | 11.75                        | 10.08            | -1.67                         | 86               | 38.61                         | Seaforde           |
| 32                        | 3.62             | +1.30                       | 156              | 47                   | 28    | 21                | 11.67                        | 16.72            | +5.05                         | 143              | 41.20                         | Londonderry        |
| 25                        | 3.18             | + .93                       | 141              | 41                   | 24    | 20                | 10.55                        | 15.12            | +4.57                         | 143              | 37.85                         | Omagh              |

## SUPPLEMENTARY RAINFALL, APRIL, 1906.

| Div.  | STATION.                          | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | ·77             | XI.    | Rhayader, Tyrmynydd .....         | 1·92            |
| „     | Ramsgate, West Cliff Villas ..... | ·48             | „      | Lake Vyrnwy .....                 | 1·59            |
| „     | Hailsham .....                    | 1·62            | „      | Llangyhanfal, Plas Draw .....     | ·60             |
| „     | Crowborough, Uckfield Lodge ..... | 1·19            | „      | Criccieth, Talarvor .....         | 1·54            |
| „     | Osborne, Newbarn Cottage .....    | 1·14            | „      | Llanberis, Pen-y-pass .....       | 4·00            |
| „     | Emsworth, Redlands .....          | ·77             | „      | Lligwy .....                      | 1·25            |
| „     | Alton, Ashdell .....              | ·85             | „      | Douglas, Woodville .....          | 1·82            |
| „     | Newbury, Welford Park .....       | 1·02            | XII.   | Stoneykirk, Ardwell House .....   | 1·02            |
| III.  | Harrow Weald, Hill House .....    | ·47             | „      | Dalry, The Old Garroch .....      | 1·88            |
| „     | Oxford, Magdalen College .....    | ·34             | „      | Langholm, Grove Road .....        | 2·00            |
| „     | Bloxham Grove .....               | ·62             | „      | Moniaive, Maxwellton House .....  | 1·51            |
| „     | Pitsford, Sedgebrook .....        | ·42             | XIII.  | N. Esk Reservoir [Penicuik] ..... | 1·70            |
| „     | Huntingdon, Brampton .....        | ·56             | XIV.   | Maybole, Knockdon Farm .....      | 1·52            |
| „     | Wisbech, Bank House .....         | 1·05            | „      | Campbeltown, Witchburn .....      | 1·85            |
| IV.   | Southend Water Works .....        | ·78             | XV.    | Inveraray, Newtown .....          | 3·59            |
| „     | Colchester, Lexden .....          | ·88             | „      | Ballachulish House .....          | 4·45            |
| „     | Newport, The Vicarage .....       | 1·04            | „      | Islay, Eallabus .....             | 3·02            |
| „     | Rendlesham .....                  | ·57             | XVI.   | Dollar Academy .....              | 1·51            |
| „     | Swaffham .....                    | ·72             | „      | Loch Leven sluice .....           | 1·05            |
| „     | Blakeney .....                    | ·59             | „      | Balquhider, Stronvar .....        | 2·59            |
| V.    | Bishops Cannings .....            | 1·04            | „      | Perth, Pitcullen House .....      | ·90             |
| „     | Ashburton, Druid House .....      | ·96             | „      | Coupar Angus Station .....        | ·92             |
| „     | Okehampton, Oaklands .....        | 1·67            | „      | Blair Atholl .....                | 1·30            |
| „     | Hartland Abbey .....              | 1·29            | „      | Montrose, Sunnyside Asylum .....  | 1·14            |
| „     | Lynmouth, Rock House .....        | 1·32            | XVII.  | Alford, Lyntark Manse .....       | 1·76            |
| „     | Probus, Lamellyn .....            | 1·81            | „      | Keith Station .....               | 2·01            |
| „     | Wellington, The Avenue .....      | ·98             | XVIII. | N. Uist, Lochmaddy .....          | 2·90            |
| „     | North Cadbury Rectory .....       | 1·23            | „      | Alvey Manse .....                 | 2·21            |
| VI.   | Clifton, Pembroke Road .....      | 1·36            | „      | Loch Ness, Drumnadrochit .....    | 1·91            |
| „     | Moreton-in-Marsh, Longboro' ..... | ·75             | „      | Glencarron Lodge .....            | 7·26            |
| „     | Ross, The Graig .....             | ·93             | „      | Fearn, Lower Pitkerrie .....      | 1·46            |
| „     | Shifnal, Hatton Grange .....      | 1·77            | XIX.   | Invershin .....                   | 2·71            |
| „     | Cheadle, The Heath House .....    | 1·88            | „      | Altnaharra .....                  | 2·88            |
| „     | Coventry, Kingswood .....         | ·46             | „      | Bettyhill .....                   | 1·73            |
| VII.  | Market Overton .....              | ·57             | „      | Watten Station .....              | 1·52            |
| „     | Market Rasen .....                | ·88             | XX.    | Dunmanway, The Rectory .....      | 1·62            |
| „     | Bawtry, Healey Hall .....         | ·60             | „      | Cork .....                        | 1·06            |
| VIII. | Neston, Hinderton .....           | ·81             | „      | Darrynane Abbey .....             | 2·14            |
| „     | Southport, Hesket Park .....      | 1·02            | „      | Glenam [Clonmel] .....            | 1·51            |
| „     | Chatburn, Middlewood .....        | 1·30            | „      | Ballingarry, Gurteen .....        | 2·02            |
| „     | Cartmel, Flookburgh .....         | 1·65            | „      | Miltoyn Malbay .....              | 1·62            |
| IX.   | Langsett Moor, Up. Midhope .....  | 1·18            | XXI.   | Gorey, Courtown House .....       | 1·38            |
| „     | Scarborough, Scalby .....         | 1·06            | „      | Moynalty, Westland .....          | 1·30            |
| „     | Ingleby Greenhow .....            | 1·08            | „      | Athlone, Twyford .....            | 1·56            |
| „     | Mickleton .....                   | ·76             | „      | Mullingar, Belvedere .....        | 1·85            |
| X.    | Bardon Mill, Beltingham .....     | 1·19            | XXII.  | Woodlawn .....                    | 2·21            |
| „     | Ewesley, Fallowes .....           | 1·06            | „      | Westport, Murriak Abbey .....     | 2·68            |
| „     | Ilderton, Lilburn Cottage .....   | 1·00            | „      | Collooney, Markree Obay .....     | 3·01            |
| „     | Keswick, York Bank .....          | 1·26            | XXIII. | Enniskillen, Portora .....        | 2·15            |
| XI.   | Llanfrecfa Grange .....           | 1·17            | „      | Warrenpoint, Summer Hill .....    | 1·59            |
| „     | Treherbert, Tyn-y-waun .....      | 1·68            | „      | Banbridge, Milltown .....         | 2·29            |
| „     | Carmarthen, The Friary .....      | 1·17            | „      | Belfast, Springfield .....        | 2·57            |
| „     | Castle Malgwyn [Llechryd] .....   | 1·56            | „      | Bushmills, Dundarave .....        | 3·13            |
| „     | Plymlimon .....                   | 3·50            | „      | Stewartstown, The Square .....    | 2·46            |
| „     | Tall-y-llyn .....                 | 1·40            | „      | Killybegs .....                   | 4·68            |
| „     | New Radnor, Ednol .....           | 1·89            | „      | Horn Head .....                   | 2·87            |

## METEOROLOGICAL NOTES ON APRIL, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; Ts for Thunderstorm; R for Rain; H for Hail; S for Snow.

**LONDON, CAMDEN SQUARE.**—Apart from the low temp. a very fine month, with an extraordinarily large amount of sunshine and practically no rain until the last week. Absolute drought from March 27th to April 12th, and partial drought from March 24th to April 26th, 34 days with  $\cdot 34$  in. of E. The temp. was rather low under the influence of persistent polar winds, the mean being  $47^{\circ} \cdot 2$ , or  $0^{\circ} \cdot 9$  below the average. Duration of sunshine 192 $\cdot$ 9\*, and of E 9 $\cdot$ 9 hours.

**CROWBOROUGH.**—No E fell from March 27th till April 17th, with delightfully warm and sunny days. The latter part was wintry with frequent H and S. E  $\cdot 99$  in. below the average of 35 years. Mean temp.  $45^{\circ} \cdot 4$ .

**HARTLEY WINTNEY.**—The driest April since 1893. Genial weather prevailed for the first fortnight, but afterwards it was bitterly cold with many frosts.

**TORQUAY.**—Duration of sunshine 258 $\cdot$ 8\* hours, or 82 $\cdot$ 8 hours above the average; no sunless days and 14 days with more than 10 hours. Mean temp.  $46^{\circ} \cdot 8$ , or  $1^{\circ} \cdot 9$  below the average.

**NORTH CADBURY.**—Abnormally warm until 17th, and as abnormally cold from 18th to 30th, but cold nights throughout. Partial drought from March 16th to April 23rd, 39 days with  $\cdot 39$  in. of E.

**CLIFTON.**—Mostly anticyclonic weather with N. and N.E. winds. Fine till 20th with cold nights, and the last 10 days very cold with ground frosts.

**ROSS.**—The first half was splendid and warmer than the average, but the latter half was the coldest in 27 years, except 1884 and 1887.

**BOLTON.**—Brilliantly fine and warm till about 17th, with almost entire absence of E. The latter part was cold and wet, with 8 showers and ground frosts. Duration of sunshine 119 $\cdot$ 5\* hours, or 8 $\cdot$ 6 hours above the average. Mean temp.  $43^{\circ} \cdot 8$ , or  $0^{\circ} \cdot 2$  below the average.

**SOUTHPORT.**—Dry and sunny with light E. airs till 12th, W. winds later with E. Mean temp.  $45^{\circ} \cdot 2$ , or  $0^{\circ} \cdot 7$  below the average. Duration of sunshine 209 $\cdot$ 8\* hours, or 30 $\cdot$ 8 hours above the average. E  $\cdot 70$  in. below the average. Duration of E 24 $\cdot$ 9 hours.

**CARMARTHEN.**—Unusually cold and dry with bitter N. and E. winds. The season was generally backward and E was everywhere badly wanted.

**HAVERFORDWEST.**—Fine, cold and very dry, with frost on many nights and S on 28th. Vegetation was backward and E much needed. Duration of sunshine 244 $\cdot$ 8 hours.

**DOUGLAS.**—Brilliantly fine, dry and very cold to 15th, when the drought, which had lasted 21 days, broke up and was succeeded by wild wintry weather with cold E, frequent S, H and sleet and almost nightly frost.

**DUMFRIES.**—The promise of early spring growth during the exceptionally mild weather of the first two weeks completely disappeared with the low temp. and withering winds of the second half, when frost caused much havoc.

**COUPAR ANGUS.**—E again below the average, this being the third successive month with a deficit. Cold nights and warm days; mean temp.  $42^{\circ} \cdot 7$ , or slightly below the average. Vegetation was practically stationary.

**DARRYNANE ABBEY.**—E 60 per cent. of the average, and less than that of any April except 1872, 1873, 1896 and 1903.

**DUBLIN.**—A cold month, the mean temp. being  $45^{\circ} \cdot 9$ , or  $1^{\circ} \cdot 8$  below the average. The first half was very dry, the latter notable for frequent E.

**OMAGH.**—The first fortnight, although accompanied by polar and easterly winds, was dry and often brilliant, and a highly favourable seed time, but it is seldom we have had more raw, wet, inclement, and generally unfavourable April weather than that from 13th to the end. There were more frosts and S than in any winter month, and vegetation was checked by the cold.

\* Campbell-Stokes.



## Climatological Table for the British Empire, November, 1905.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain. |       | Aver. |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|-------------|-------|-------|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.      | Days. |       |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |      |               |           |                 |                   |             |       |       |
|                                                                  | °         |       | °        |       | °        | °    | °             | 0-100     | °               | °                 | inches      |       |       |
| London, Camden Square                                            | 55·2      | 26    | 24·2     | 21    | 47·4     | 36·2 | 39·6          | 92        | 75·8            | 17·5              | 8·08        | 19    | 6·8   |
| Malta.....                                                       | 78·1      | 21    | 51·3     | 28    | 70·8     | 58·9 | 55·5          | 78        | 118·4           | 46·8              | 1·14        | 7     | 4·9   |
| Lagos.....                                                       | 90·0      | 30    | 74·0     | 24    | 86·4     | 75·3 | 75·4          | 78        | 141·0           | 62·5              | 3·65        | 9     | 6·5   |
| Cape Town ...                                                    | 81·2      | 18    | 45·7     | 21    | 71·8     | 54·9 | 53·1          | 70        | ...             | ...               | ·89         | 5     | 3·4   |
| Durban, Natal .....                                              | 89·1      | 3     | 54·4     |       | 77·8     | 63·3 | ...           | ...       | 151·5           | ...               | 6·87        | 16    | 6·4   |
| Johannesburg .....                                               | 84·8      | 30    | 42·0     | 7     | 73·0     | 52·7 | 51·9          | 72        | 159·2           | 43·0              | 6·05        | 13    | 4·0   |
| Mauritius.....                                                   | 89·0      | 17    | 60·5     | 2     | 83·4     | 67·3 | 65·7          | 74        | 149·7           | 53·1              | 4·09        | 13    | 6·6   |
| Calcutta.....                                                    | 87·0      | 12    | 57·1     | 17    | 83·1     | 63·6 | 62·4          | 70        | 149·0           | 51·5              | ·00         | 0     | 1·8   |
| Bombay.....                                                      | 93·2      | 8     | 68·3     | 27    | 88·9     | 74·9 | 69·2          | 67        | 142·3           | 61·9              | 1·04        | 3     | 3·0   |
| Madras .....                                                     | 89·5      | 2     | 67·9     | 5     | 85·8     | 73·7 | 72·1          | 81        | 140·8           | 63·8              | 10·99       | 16    | 5·8   |
| Kodaikanal .....                                                 | 65·1      | 1     | 41·8     |       | 60·8     | 49·5 | 50·8          | 88        | 134·8           | 35·3              | 7·77        | 20    | 6·3   |
| Columbo, Ceylon.....                                             | 90·8      | 6     | 73·0     | 6     | 87·4     | 75·1 | 73·4          | 82        | 157·3           | 69·0              | 5·12        | 18    | 5·3   |
| Hongkong.....                                                    | 84·5      | 3     | 59       | 5     | 73·6     | 65·0 | 57·1          | 66        | 138·1           | ...               | ·28         | 8     | 4·8   |
| Melbourne.....                                                   | 93·5      | 8     | 41·5     | 13a   | 71·0     | 49·6 | 47·8          | 67        | 152·3           | 32·0              | 1·25        | 6     | 5·5   |
| Adelaide .....                                                   | 92·4      | 15    | 42·9     | 5     | 75·5     | 51·1 | 47·3          | 56        | 151·0           | 34·1              | ·15         | 2     | 3·6   |
| Coolgardie .....                                                 | 107·2     | 24    | 43·4     | 11    | 87·9     | 66·0 | 45·7          | 39        | 169·1           | 39·2              | ·21         | 3     | 2·2   |
| Sydney .....                                                     | 98·1      | 17    | 45·8     | 1     | 76·6     | 58·7 | 52·9          | 60        | 134·9           | 38·8              | ·68         | 14    | 4·5   |
| Wellington .....                                                 | 71·8      | 18    | 43·6     | 9     | 62·4     | 50·5 | 46·6          | 68        | 132·0           | 39·0              | 3·32        | 15    | 6·7   |
| Auckland .....                                                   | 71·0      | 30    | 45·0     | 10    | 64·9     | 53·7 | 49·8          | 72        | 138·0           | 39·0              | 2·30        | 14    | 5·0   |
| Jamaica, Negril Point..                                          | 88·9      | 20    | 68·9     | 28a   | 86·6     | 71·6 | 73·0          | 81        | ...             | ...               | 5·75        | 10    | ...   |
| Trinidad .....                                                   | ...       | ...   | ...      | ...   | ...      | ...  | ...           | ...       | ...             | ...               | ...         | ...   | ...   |
| Grenada.....                                                     | 86·2      | 6     | 71·8     | 26    | 83·7     | 74·9 | 80·8          | 95        | 154·0           | ...               | 12·23       | 25    | 4·7   |
| Toronto .....                                                    | 54·0      | 11    | 12·7     | 30    | 43·6     | 30·2 | 30·1          | 77        | 68·0            | 8·2               | 1·78        | 13    | 6·3   |
| Fredericton .....                                                | 56·8      | 25    | —2·5     | 15    | 43·2     | 23·7 | 24·3          | 62        | ...             | ...               | 3·58        | 11    | 6·3   |
| Winnipeg .....                                                   | 59·5      | 10    | —21·0    | 30    | 35·1     | 18·2 | ...           | ...       | ...             | ...               | 1·13        | 7     | 5·5   |
| Victoria, B.C. ....                                              | 59·2      | 12    | 27·9     | 28    | 49·0     | 40·5 | ...           | 90        | ...             | ...               | ·91         | 11    | 7·1   |
| Dawson .....                                                     | 46·0      | 10    | —20·0    | 26    | 15·9     | 4·8  | ...           | ...       | ...             | ...               | ·31         | 5     | 6·4   |

a and 29. b and 29.

MALTA.—Mean temp. of air 63°·6, or 1°·7 above average. Mean hourly velocity of wind 10·0 miles, or 0·6 above average. Mean temp. of sea 67°·9.

MAURITIUS.—Mean temp. of air 0°·6 below, of dew point 1°·4, and E 2·26 in. above, averages. Mean hourly velocity of wind 9·3 miles, or 1·4 below average.

MADRAS.—Bright sunshine 160·5 hours.

KODAIKANAL.—Bright sunshine 114 hours.

COLOMBO.—Mean temp. of air 80°·8, or 0°·9 above, of dew point 1°·1 above, and E 7·06 in. below, averages. Mean hourly velocity of wind 5·7 miles.

HONGKONG.—Mean temp. of air 69°·2. E 1·43 in. below average. Mean direction of wind E. by N., and mean hourly velocity 12·4 miles. Bright sunshine 209·0 hours.

ADELAIDE.—Mean temp. of air 3°·9 below, and E ·85 in. below, averages; one of the driest Novembers on record. Mean min. temp. lowest on record for 48 years.

SYDNEY.—E 2·42 in. below, mean temp. 0°·8 above, and humidity 9 below, averages.

AUCKLAND.—E not quite two-thirds of the average of previous 37 years.

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VOL. XLI.

## THE RAINFALL OF MAY AND THE FIVE MONTHS OF 1906.

OUR rainfall tables and correspondence this month show that May was wet, and in some parts of the country an unprecedentedly wet month. As not infrequently happens towards the end of spring, there were local thunderstorms of considerable intensity which brought heavy plumps of rain to small areas. The most conspicuous case of this was at Brundall, near Norwich, where 3·21 in. fell in twelve hours on May 13th, and consequently at that station the total rainfall of the month was more than two and a half times the average. Other instances occurred at Haslemere and at Upton, near Slough, on the 8th, when about 2 inches fell at certain stations, while, as in the case of Brundall also, at stations not many miles distant there was quite a moderate fall. Apart from such local splashes the great block of central England reaching from London and Bath on the south to Hull and Derby on the north was dry, the rain which fell over it being only about 80 per cent. of the average. A dry patch also occurred along the sheltered east coast of the South Devon peninsula. All the rest of the country was wet, and over the north of England and the centre and east of Scotland more

### *Comparison of May, 1906, and the Wettest Previous May.*

|                           | Record<br>com-<br>menced. | Aver.    |               | Per<br>cent.<br>of Aver. | Wettest previous May. |                      |       |
|---------------------------|---------------------------|----------|---------------|--------------------------|-----------------------|----------------------|-------|
|                           |                           | 1870-89. | May,<br>1906. |                          | Amount                | Per cent<br>of Aver. | Date. |
|                           |                           | in.      | in.           |                          | in.                   |                      |       |
| Arneliffe .....           | 1859                      | 3·36     | 7·08          | 211                      | 6·72                  | 200                  | 1892  |
| Newcastle, Town Moor ...  | 1868                      | 1·89     | 4·78          | 253                      | 3·59                  | 190                  | 1899  |
| Ilderton, Lilburn .....   | 1856                      | 1·95     | 8·15          | 418                      | 4·93                  | 253                  | 1865  |
| Pawston [Coldstream]..    | 1873                      | 1·95     | 8·10          | 416                      | 4·00                  | 205                  | 1885  |
| Borrowdale, Seathwaite... | 1845                      | 7·26     | 16·10         | 222                      | 17·09                 | 235                  | 1884  |
| Cargen, [Dumfries] .....  | 1860                      | 2·60     | 7·00          | 269                      | 6·66                  | 256                  | 1865  |
| Edinburgh, Charlotte Sq.. | 1850                      | 1·86     | 4·91          | 264                      | 4·11                  | 221                  | 1886  |
| Dundee, E. Necropolis ... | 1866                      | 1·88     | 5·00          | 266                      | 4·00                  | 213                  | 1899  |
| Braemar .....             | 1857                      | 2·29     | 5·45          | 238                      | 6·18                  | 270                  | 1873  |
| Dunrobin Castle .....     | 1860                      | 2·02     | 4·50          | 223                      | 3·55                  | 176                  | 1894  |

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than twice, and over the Cheviot Hills more than four times, the average amount of rain fell. The west coast, although receiving nearly half as much again as its usual liberal allowance of rain, was almost equalled in the total amount recorded along the normally dry east coast. There were, in fact, very few places in Scotland in which the rainfall of May did not exceed 5 inches. To concentrate attention on this area of remarkably large rainfall we quote the figures recorded at a few of the stations which possess long records and add for each station the greatest fall in May previously reported. We regret, however, that our Scottish readers in the wet area have not favoured us with more details of their rainfall.

The area referred to last month as having escaped most of the earlier heavy falls came under the full influence of the May rains, with the result that practically the whole of the British Isles has now received more than the average fall for the five months. There may be a deficiency in the extreme south-west of Ireland, and a very slight deficiency in a narrow strip of the northern Midlands in England; but the general rainfall of England and Wales for so much of the present year as has passed may be taken as showing an excess over the average of 20 per cent., Scotland 23 per cent., Ireland 18 per cent. and the British Isles as a whole 20 per cent.; in other words, there is, compared with the average of thirty years, about one month's rainfall to the good. So far, then, we may say, even if June should turn out a dry month, that the first half of the year justifies the expectation, based on the frequent recurrence of a wet year preceded by two dry years, that 1906 may prove wet on the whole.

### LINE SQUALLS AND THUNDERSTORMS.

THE following is an abstract of an important paper on the law of squalls and thunderstorms,\* by E. Durand-Greville:—

Upon the approach of a line-squall the wind suddenly increases in force and changes in direction, generally from south-west to north-west. These changes in the force and direction of the wind are accompanied by a considerable fall of temperature and a considerable increase of humidity; in the case of hot, dry squalls like the simoon of the Sahara and the sirocco of southern Europe, these changes of temperature and humidity do not occur. The squall may bring a storm of rain, hail or snow according to the season, with or without thunder and lightning.

The barometer which falls rapidly immediately before the squall, shows a sudden increase of pressure as soon as the wind increases in force. The barogram of a squall is very characteristic, showing this sudden rise of the barometer.

All places which are affected by the squall at the same time form a long continuous strip, from six to thirty miles or more in breadth, called the

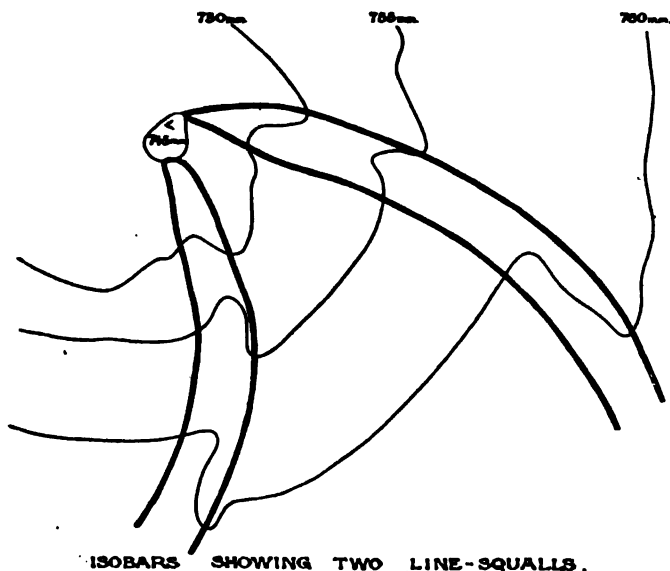
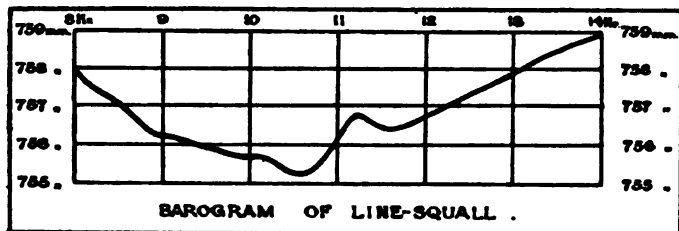
\* "Le loi des Grains et des Orages," in Nos. 12 (1905) and 1 (1906) of the *Bulletin de la Société Belge d'Astronomie*.

squall strip (*le ruban de grain*). One of the extremities of the squall strip is generally found near the central region of the atmospheric depression in which it occurs; the other extremity occasionally extends into a contiguous anticyclone. When the atmospheric depression, in which the squall occurs, has a rapid movement of translation the squall area protuberates in the corresponding direction; when, however, the depression moves slowly the squall strip rotates like the spoke of a wheel, round the centre of the depression in a direction, north of the equator, opposite to that of the hands of a watch. The isobars of a line-squall have a characteristic zigzag shape (see figure). Several squalls may exist in one atmospheric depression, and these may greatly interfere with the normal sequence of phenomena as observed at any given place.

It seems probable that the squall is fed by a descending current of air from a long distance and a great height, and that it in turn feeds an ascending current of air, which moves away from the squall in the opposite direction. The descending wind in the squall strip, and the ascending wind in front of it, would explain the fact that pressure is abnormally high in the former area and abnormally low in the latter. Over the entire area of the squall barometric pressure is higher, humidity greater, temperature lower and wind stronger, than in front or in rear of the squall. In the United States, tornadoes occur along the front line of the squall area. Wherever the squall, in its passage across the land, finds suitable atmospheric conditions it produces destructive rain and hailstones; hence, hailstorms are most frequent and violent during the warm period of the year.

Over large portions of the squall area the sky is clear, over other large portions it is overcast, whilst over restricted portions of the cloudy area disastrous rain and hailstorms, accompanied by thunder and lightning, occur.

Monsieur Durand-Greville insists that the majority of thunderstorms in middle latitudes are of the line-squall type discussed in this paper. This, no doubt, is the case in France; but neither the investigations of the British Thunderstorm Committee, nor our general experience of summer thunderstorms in England, associate these phenomena ordinarily with the passage of line-squalls moving laterally across the country. Probably the difference between the atmospheric conditions accompanying French and English thunderstorms is of degree only not of kind, and English thunderstorms may not be fully developed phenomena as compared with French. Summer thunderstorms in England are usually associated with a local squall, sometimes at the Earth's surface but more generally a little above it, and the conditions giving rise to these local squalls might be found could a minute enough study of the general atmospheric conditions accompanying thunderstorms be made, to represent the embryo conditions of a line-squall. It must not be forgotten that the summers of England are cool and moist, those of France hot and dry, and that, consequently, the state of the atmosphere in the latter country at that season is eminently conducive to the development of frequent and severe thunderstorms.



The figures, which are adapted from Monsieur Durand-Greville's paper, show respectively the barogram and isobars characteristic of line-squalls. In the first it will be seen that the sudden increase of pressure which occurs when the squall strikes a place, is preceded by an increased rate of fall of the barometer. In the second the two ribbon-shaped squall areas and the sharp inflections of the isobars associated with them call for remark.

L.C.W.B.

## DR. W. N. SHAW ON THE CIRCULATION OF THE ATMOSPHERE.

II.—The second lecture of Dr. Shaw's Course at the University of London was devoted to illustrations of the weather experienced in different parts of the general circulation of the atmosphere, referring in turn to the regions of permanent high pressure, those of persistent winds, areas subjected to tropical hurricanes, regions of periodical or monsoon winds, and finally the region of the North Atlantic "low." Rainfall was more particularly considered as the most convenient index of weather conditions. It was pointed out that in no part of the ocean is there persistent or absolute drought, though in the permanent high pressure areas and those of the Trade Winds the rainfall is small and infrequent over the sea. Thus near sea level at St. Helena and Ascension only 4 or 5 inches fall, whereas inland at an altitude of 2000 feet as much as 40 or 50 inches per annum have been observed.

The rainfall in the monsoon regions was illustrated by diagrams taken from a recent publication of the Solar Physics Observatory, showing how the rainfall was associated with the summer cyclonic circulation.

The phenomena of tropical revolving storms was illustrated by a diagram of the *baguio* of October, 1882, by Father Algué, of Manila Observatory.

Various examples of depressions of the North-east Atlantic were examined, first as to their broad features, showing how masses of air which move toward the centres of depressions are responsible for the deposition of rainfall. These frequently converge greatly and in slow-moving cyclones deposit large amounts of rain.

Changes due to minor disturbances of pressure were exhibited by diagrams giving examples of sudden barometric change and fall of temperature with heavy rain, and finally still smaller but none the less distinct disturbances shown by the micro-barograph alone.

III.—In the third lecture attention was first directed to the normal circulation taking place in that portion of the atmosphere lying at an altitude of more than 4000 metres above the surface of the Earth. M. Teisserenc de Bort's map of the pressure distribution at this high level for January shows that the main feature is a general movement from west to east round the poles, modified in the northern hemisphere by deviations from N.W. over the land areas and S.W. over the oceans. This map was produced by deducting from the average atmospheric pressure at the surface the computed weight of the stratum of air below 4000 metres, and a map of the pressure due to the lower stratum alone was exhibited in order to bring to notice the remarkable fact that the lie of the isobars is strikingly similar to that in the upper stratum, but with the gradients in every case reversed.

The surface pressure conditions may therefore be looked upon as the result of the superposition of two different components, each nearly the reverse of the other, the upper tending to produce a circulation of air from west to east round the poles and the lower, due to surface temperature, a circulation from east to west. As a consequence westerly circulation results where the upper component predominates, easterly where the lower is more powerful. It is noticeable that, as a matter of fact, the lower component seems seldom to preponderate, but this may probably be accounted for by the imperfect investigation of the areas of greatest cold where the surface circulation is strongest.

Good confirmation of the theory of circulation advanced is obtained from the observations made by the Antarctic Expedition on the *Discovery*, near Mount Erebus, where the mean wind direction shows a decided tendency to be easterly at the lowest point of observation, is about equally divided between all points of the compass at middle altitudes and is strongly westerly at the summit. The easterly drift at the surface was borne out by the German expedition on the *Gauss* which wintered on the Antarctic circle some seventy degrees west of the longitude of the *Discovery*.

The relation of rainfall to the general circulation and local disturbances was also discussed, and it was pointed out that the deposition of rain is almost entirely due to the ascent of masses of air bringing about rarefaction and cooling. This is equally the case with the rainfall accompanying depressions, with orographical rainfall, and with rain of the local or thunderstorm type. Several diagrams were exhibited with a view to showing that the moisture deposited as rain in this country is taken from air moving from south to north approaching the centres of depressions. Currents from the south consequently travel for comparatively short distances before disappearing and are therefore less persistent than easterly and westerly currents. They may be considered as supplying the energy necessary to maintain the general westerly circulation of the atmosphere and are powerful agents in distributing the heat of the Sun over the Earth.

Maps were also shown which demonstrated in what respects deviations from normal conditions may influence the weather of individual months and thus exercise a temporary effect on the whole circulation.

(To be continued.)



## TREACHEROUS CHARACTER OF THE ENGLISH SPRING.

By L. C. W. BONACINA.

THE treacherous and changeable character of the weather during the months of March, April and May is one of the most prominent and constant features of the climate of the British Islands.

It is quite a common occurrence for a day in April or May, with afternoon temperatures between 70° and 80° F. in the shade, to be followed within forty-eight hours by harsh northerly winds, squalls of sleet and hail, afternoon temperatures between 40° and 50° F. and keen night frosts, inflicting serious injury upon vegetation at the critical period of the year. The spring of the present year 1906 has been remarkable only in this, that the changes of temperature have occurred with more than usual rapidity and suddenness.

Cloudless skies, brilliant sunshine and shade temperatures between 60° and 70° F. on the 6th and 7th of March were followed during the night of the 12th in the London district by the heaviest fall of snow of the winter. On the 17th the conditions of the 6th and 7th repeated themselves, and on the 19th there set in a ten-day period of really terrible weather, of which the cold was conspicuous, not so much for its intensity as for the raw, disagreeable qualities of the north-easterly wind which brought it.

The first half of April was brilliantly fine, with moderately high day temperatures, and just before Easter there occurred a few days of thundery heat with temperatures locally over 70° F. Immediately after Easter these summerlike conditions gave place to a very bleak type of weather, with cold rain, hail and snow squalls (very heavy snow fell in Scotland), which with but little interruption lasted till the close of the month.

The snowstorm of the morning of the 24th of April was experienced very generally in the east and south-east of England and in places it was heavy.

The late spring month, May, did not fail to reproduce the sudden and rapid temperature variations of the early and mid-spring months, March and April. On the 8th of May the shade temperature was between 70° and 80° F. in the south and centre of England, and a severe thunderstorm occurred towards evening in east Berkshire (two inches of rain at Slough) and west Middlesex. Forty-eight hours later, on the 10th, temperature barely reached 50° F., the wind being north with overcast skies and characteristic tawny horizon. Thundery conditions, with temperatures over 70° F. in the shade, recurred on the 13th. On the 17th a well-marked snow sky prevailed in London and the maximum temperature was no higher than 49°; snow showers fell in several parts of the country that day and at 6 p.m. sleet, accompanied by a bleak northerly gale, was actually falling in the Scilly Isles (*Weather Report*). During the night of the 17th the air temperature fell to 28° F. at Nottingham



and a severe ground frost was experienced generally. In the Darent Valley, in Kent, much of the late expanding foliage of oak and ash was blackened by the frost. After a cold and heavy northerly wind, rain, exposure to which numbed the fingers, on the 20th, the weather assumed a softer and more summerlike character, and the gentle rains of the 26th were associated with some very beautiful mountain mists in the hill-country of the Kent and Surrey borderland.

The spring of 1906 has, on the whole, been a typical English spring so far as treacherous weather is concerned, but owing to the prolonged drought of March and April the most delicate verdure of the year, as exhibited by the larch, elm and horse-chestnut, was inferior to that of many other years.

The changeable and uncertain weather of the spring months, associated as it is with a mean temperature that normally does not, even in the south, reach the temperate\* level, 55° F., till the latter part of May, though distressing to invalids and often inconvenient to the strong, has the effect of greatly enhancing the peculiar charm of the spring in a land so green as England, where the various elements of greenery show different and contrasted phases of beauty with the different types of weather. Consider, for example, the pageantry of our woodlands during the month of May; then the woodlands with their blue carpet of wild hyacinths striking so great a contrast against the reddish-green tint of the expanding oak foliage above them, reveal subtle passages of beauty that alter in tone and expression with every change of weather.

The causes of the uncertain weather of spring must be attributed to the fact that solar radiation is powerful at that season, whilst the ground and air remain cold. The returning sun always tends to produce local areas of high temperature, especially in districts away from the sea, and as these local heat areas are surrounded by large areas which have not thus been heated, a speedy relapse into the cold of winter over the former areas is inevitable. Besides this, there is a great tendency for cold north-easterly winds to prevail in spring as the result of the excess of air accumulated over the great continents during the winter months.

There is another peculiarity of spring weather in England that is worth notice: it is, that snow is apt to fall with much higher temperatures in spring than in winter or late autumn. During the spring months snow showers frequently prevail when the temperature of the air near the surface of the land, as an effect of solar radiation, is between 40° and 50° F. (although a heavy snow-squall will in-

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\* The fixing of 55° F. as temperate is by no means arbitrary, as this temperature, though nearly 44° below the temperature of the human body, appears on the whole to be more comfortable than any other to men in health and in civilized life, as is evidenced by the fact that whenever the temperature of the air is below that point the need for sitting-room fires makes itself felt, whilst whenever it is much above that point artificial heating in the house becomes oppressive.

variably cause a temporary reduction of temperature to the freezing point), whilst during the winter months snow seldom falls with a temperature as high as 40° F. This indubitably proves that the relatively high temperature often accompanying spring snow-showers belongs to the surface air only, the strata of air at a short distance from the ground and up to the clouds being intensely cold. The same northerly type of weather in winter would be accompanied by surface temperatures near the freezing point, a temperature over 40° F. in winter generally only occurring when a mild wind of considerable height from the Atlantic prevails, rendering the formation of snow-clouds impossible. During January, 1906, a month it will be remembered of rain-bearing cyclonic storms, snow-clouds were scarcely ever seen in the south of England, whereas during February, March and April they were the prevailing cloud forms, and even in May were quite common, being very conspicuous on the 10th, 16th and 17th.

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### ROYAL METEOROLOGICAL SOCIETY.

THE first of the Afternoon Meetings for the present session was held on Wednesday, May 16th, in the Society's Rooms, 70, Victoria Street, Westminster, Mr. Richard Bentley, President, in the chair.

Dr. W. N. Shaw, F.R.S., read a paper, which he had prepared in conjunction with Mr. G. C. Simpson, describing an Instrument for testing and adjusting the Campbell-Stokes Sunshine Recorder. Experience has shown the necessity of an instrument for testing the shape and dimensions of recorders, and of verifying their adjustment when installed. But it is not at all easy by mere inspection or simple measurements with ordinary measuring instruments to check the adjustment, nor is it possible on a sunless day, without some special appliance, to check the orientation and thus the time scale of the sunshine recorder. The difficulty in carrying out the necessary tests without a special instrument arises from the fact that the positions of all the parts of the recorder must be referred to the optical centre of the glass ball. For suitably uniform glass this is also the geometrical centre of the sphere. It is inaccessible for purposes of measurement when the sphere is in position, and is entirely undefined when the sphere is removed. The first step in designing an instrument for testing recorders is, therefore, to get some means of identifying, in a way that can be used practically, the centre of a 4-inch sphere placed in the pedestal. This has been done by making a metal cone, the base of which is accurately turned to form a portion of a sphere of two inches radius and the point is at the exact centre of the spherical surface. Thus the point of the cone will always be in the position of the centre of the recording ball when the base of the cone stands on a pedestal. The second step is to provide a table, with levelling screws, that will carry a pair of adjustable

points to be set level and form the ends of a line (the axial line) touching the six o'clock marks at each end. The third step is to provide a pointer that sweeps round in a plane, passing through the axial line. The fourth step is to provide the means for setting the plane in which the pointer moves at any angle to the horizontal table, in order to test the adjustment for latitude. The fifth step is to provide the means for determining with the aid of a map that the axial line should be exactly east and west.

Dr. Shaw showed the complete instrument, which had been made from Mr. Simpson's drawings.

In the discussion on the paper, Mr. R. H. Curtis, Mr. W. Marriott, Mr. R. Inwards, Mr. F. C. Bayard, Mr. W. Ellis, and the President took part, and Dr. Shaw replied.

Mr. R. G. K. Lempfert read a paper on "The Development and Progress of the Thunder-Squall of February 8th, 1906." This squall was first noted at Stornoway soon after midnight, and the last station in England to feel its effect was Hastings, over which it passed at about 4 p.m. The rate of progress was nearly uniform, though it increased somewhat in the south-east of the country, where the thunder and hailstorms were most intense. The average speed of advance of the line of squall was about 38 miles per hour. The most marked feature of this squall was the sudden shift of the wind, in the course of a few minutes, from south-west to north-west, and it was during this period that the thunderstorm occurred, accompanied by a rise of barometric pressure and a fall of temperature.

The discussion on this paper was postponed till the next meeting on June 20th.

The following gentlemen were elected Fellows of the Society :—  
Dr. A. G. R. Cameron, Mr. E. W. Stacey Jones, Mr. H. K. Mukherji, Capt. R. Parcou, Capt. W. H. Rothwell, and Mr. L. C. H. Young.

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

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### ON COLD IN FEBRUARY AND MARCH.

My estimate of March this year as cold at Greenwich is based on the daily means published in the *Weekly Return*. By another mode of calculation (max. and min.) the month comes out slightly *over* (instead of slightly *under*) the average, so according with your own result for Camden Square.

ALEX. B. MACDOWALL.

*Southgate, Buxton, 1st May, 1906.*

## THE GREEN FLASH.

WHILE I entirely accept the explanation of the "Green Flash" so admirably expounded by Dr. Rambaut, I fear I must still hold to the opinion that it does not explain all the phenomena that have been described under this name. The common "green," or as I would rather call it "blue" flash which I have seen, perhaps a hundred times, is undoubtedly caused in the way described by Dr. Rambaut, but there is another phenomenon which I have seen on a few occasions, which is almost as certainly due to atmospheric absorption. In it the upper part of the sun's disc when setting becomes a vivid green for several seconds before disappearing, and in the light then given objects of a green colour appear with extraordinary vividness. Probably closely allied with this phenomenon is one which I have seen here on two or three occasions, when the whole sky became filled at sunset with what seemed to be a green mist, which produced the most lurid effects.

C. MICHIE SMITH.

*The Observatory, Kodaikanal, South India, 15th May, 1906.*

WITH reference to the green flash, nearly all your correspondents mention the evening, while my sight of the green was always, or nearly always, in the morning. I appear to have been more fortunate than most of them, as I was a witness to the flash some twenty times during a voyage from Tasmania to England. I mentioned the matter to a Captain in the Navy, who had been all over the world, but he did not remember that he had ever seen it.

GEORGE H. COURTENAY.

*Southdown House, Kenion, Exeter, May 20th, 1906.*

As, in his interesting articles in the March and April numbers, Dr. Rambaut has kindly mentioned my name, perhaps I may be allowed to say that I entirely agree with his explanation of the Green Flash. I have seen the flash some dozens of times, over land, sea, and cloud horizons, recognised from the first its unquestionable objectivity, and accounted for the phenomenon by atmospheric dispersion.

But there is one real difficulty—that pointed out (p. 67) by Capt. Wilson-Barker—viz. : the absence of the flash under conditions apparently very favourable to its production, and I have not yet met with any satisfactory explanation of this fact. Upon this point reference may be made to the *Journal* of the British Astronomical Association, Vol. 15, pp. 382-4, and Vol. 16, pp. 23-5.

As another example of the mention of the Green Ray in fiction, I may instance Mrs. F. A. Steel's novel, "Red Rowans."

C. T. WHITMELL, F.R.A.S.

*Invermay, Leeds, May 19th, 1906.*

I DID not intend to trouble you again on the subject of the "Green Flash" sometimes to be seen at sunrise and sunset. I do so because I feel sure that many of your readers are not aware of the fact that this phenomenon may be seen by anyone who takes a little trouble on any evening when the sun is sinking below the horizon, and his disc is coloured red. Anyone who wishes to see the phenomenon has only to look for a few seconds at the red disc of the sun as it sinks below the horizon and then to alter slightly the direction of his eyes and the spectrum of the sun in the complementary green colour, which is the Green Flash, will at once be seen. If the disc of the sun happens to be orange colour the spectrum will be blue.

R. C. CANN LIPPINCOTT.

*Over Court, Almondsbury, Bristol, 7th June, 1906.*

### CONTINUOUS RAINFALL.

THE rainfall registered here for May was 5·36 in., an amount not equalled for that month in my record since 1860, inclusive. Some rain fell on every day in the month, but on seven of the days there was not sufficient to be measured. For the 24 hours ending at 8 a.m. on the 20th 2·41 in. fell, which has only been exceeded five times in my record. Some rain has fallen on every day from April 21st to June 1st, inclusive. For the first five months of the year 10·70 inches were registered, which was 1·90 in. above the average.

T. W. BACKHOUSE.

*West Hendon House, Sunderland, 2nd June, 1906.*

THE past month of May has been remarkably wet, the wettest I have ever recorded, the next being May, 1885, when I had only 4·00 in. The wettest months of which I have any record are—

|                  |          |                  |          |
|------------------|----------|------------------|----------|
| Dec., 1876 ..... | 9·07 in. | Oct., 1896 ..... | 7·44 in. |
| Aug., 1877 ..... | 8·21 „   | Oct., 1895 ..... | 7·02 „   |
| May, 1906 .....  | 8·10 „   | Oct., 1903 ..... | 6·99 „   |

I have not got the *daily* records for 1876 and 1877, so cannot tell what was my wettest week then; the week 13th to 19th May, 1906. is the wettest of which I have existing records; perhaps my daily records *may* be buried amongst Mr. Symons's old papers. A year or two ago, when I heard of falls of 8 inches in the month of June in the Thames Valley, we had only about 2 inches here.

My neighbour, Mr. T. Chartres, Akeld, Wooler, started a rain gauge at Christmas and reports to me that 6·28 in. fell in the first four months of the year, and 2·45 in. on May 19th, almost identical results with mine. The little mountain stream College was, I hear, unusually wild, and accounts for Till and Glen, into which it runs, being more heavily flooded than Bowmont (Bowmont and College meet and become Glen). The wild character of College is immortalized in Lyell's "Principles of Geology," Vol. 1., p. 345, 11th edition, 1872.

B. P. SELBY.

*Pawston, Mindrum, Northumberland, June 1st, 1906.*

## THE LIGHTNING RESEARCH COMMITTEE.

THE Report of this Committee, to which reference is made in the recent review of Mr. Hedges' book, was published in May, 1905, in the Journal of the Royal Institute of British Architects. It is a remarkable document and is so contradictory that it is difficult to gather what the Committee did, or did not, intend to convey.

The statistics quoted are of no more value than the recommendations it contains. It is stated that out of 125 reports received, 40 related to buildings fitted with conductors, and the context leads to the impression that these cases occurred in three years. An appendix gives what purports to be a "selection" from these 40 cases, 35 being mentioned. On analysing them we find that 8 are not damage to "protected" buildings, 1 is a case of long standing injury to a spire that no expert would attribute to lightning, and 2 occurred before the Committee was formed. This leaves 24 cases of so-called failure of lightning conductors, an average of less than 8 a year, as against nearly 400 "unprotected" buildings damaged by lightning annually in this country.

The Committee apparently ignored the fact that most of these conductors had been in use for terms varying from 20 to 60 years: had never been tested or repaired during that time; had mostly been fixed by builders, ironmongers and others not to be credited with expert knowledge, and all had grave faults that would have led a qualified expert to condemn them as inefficient before the accidents occurred. A member of the Committee, Mr. Gavey, has since publicly stated that the appendix is a complete list and not a selection, and the honorary secretary, Mr. Hedges, has acknowledged that the figures are incorrect, yet, in the book that claims to be a supplement to the Report and was published after these admissions, the statement is repeated in its original form.

It is obvious that the cases were not all adequately or even correctly described, so the Report cannot claim to be based on investigation of these. On what then is it based? Possibly on experiments by Sir Oliver Lodge, which in their practical application were strongly combated when they were carried out in public, and would be still more strongly opposed if repeated now; but it is certainly not based on extensive practical experience of the subject.

The apparent confirmation of the recommendations of the Lightning Rod Conference, which have been tested for the past 25 years and have never been known to fail, is negatived in other parts of the Report and, as an improvement, the Committee advocates methods that it declares to be ineffective! One can only say that where this Report is good it is not new and where it is new it is not good.

The Conference promoted by the Royal Meteorological Society went exhaustively into the subject so far as it was understood at the time; it invited the views of the experts of the day, compared them, rejected what appeared bad, adopted what seemed good, practice, and it issued a Report that was intended to enable the average householder to see that the most effective methods that science could

device were being applied to his building. Knowledge has progressed since then, and this Report is open to improvement in several respects, but the recent Committee has not produced an improvement but rather a retrogression, and it has only succeeded in causing distrust in the minds of those responsible for buildings as to the effectiveness of such methods of protection as are possible of application. The result is likely to be an increase in damage by lightning and many deplorable accidents that might have been prevented had different methods of investigation been adopted. ALFRED HANDS.

*London, 9th June, 1906.*

### THE THUNDERSTORM OF MAY 8th.

AS your pages record the thunderstorm of May 8th, you may like to record also an exceedingly local fall at Longdene, Haslemere, during that storm. Unfortunately the gauge is badly placed, amongst trees on a garden bed and the previous entry was made on May 1st. The rain was sudden, of great violence (washing a bed out of its place on to the garden path), and occurred between 4 p.m. and 6 p.m. At 6 p.m. the gauge was visited and contained 2.75 in.

The B during May 1—7 at Hazelhurst was .46 in.; supposing it the same at Longdene, 2.29 in. is thus left for the two hours' fall. But something must come off for splash; and the net fall would seem to have been about 2 inches.

At Court's Hill (Mr. Penfold), within half a mile, .58 in. was recorded; at Jesses (Mr. Parbury), .71 in.; at Hazelhurst, one mile N.W., .62 in.; at Grayshott (Mrs. Lyndon), four miles N.W., 1.13 in.

*Hazelhurst, Haslemere, Surrey, 6th June, 1906.* T. P. NEWMAN.

### THE PACKING OF METEOROLOGICAL INSTRUMENTS.

I READ the letter by "A. W." on the packing of meteorological instruments with great interest. My experience has been much more favourable than his. One London firm has sent me I should think pretty well a thousand pounds' worth, from time to time, and the damage to the whole lot would be covered by a £5 note. Some other firms, however, have certainly not learned how to pack. If I knew "A. W.'s" address, I should be glad to send him a specimen of my wick for wet bulbs. I will guarantee it to last for three months even in the Sahara, if properly handled. I think that all services should prepare the wick and muslin for their observers. From my own experience I should say that the black or bright bulbs could often be tested in the same way as "A. W." mentions, even in England.

We have had some glorious rains this year; not the usual heavy downpours that convert the streets into raging torrents, but steady soaking rains lasting for 20 hours at a stretch. Consequently, the country looks lovely, and very different to its burnt-up appearance when the British Association went through six months ago. J. R. SUTTON.

*Kimberley, S. Africa, March 20, 1906.*

## AUTOMATIC RECORD OF A THUNDERSTORM.

THE enclosed records given by my instruments of a fierce thunderstorm which occurred here this afternoon may interest your readers.

The storm, or rather series of storms, commenced at 2.30, and lasted until nearly 5 p.m. It was accompanied by a large quantity of hail, the stones being unusually large, a quantity of sleet also fell: the ice remaining on the ground an hour or more and lowering the grass minimum thermometer to  $33^{\circ}$ , an unusual reading for June. The total rainfall (hail, sleet and rain) was nearly 1 inch, and most of this fell in  $1\frac{1}{2}$  hours. The temperature was very variable, dropping to  $46^{\circ}$  at 5 p.m. The wind veered to the north for a few minutes, but soon backed to S.W. again. The barograph shows the sudden fluctuations so characteristic of thunderstorms.

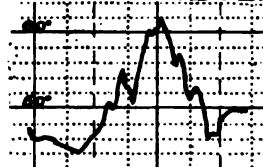
Some houses a few yards away were struck by the vivid lightning, and the telephone was cut off. This place, although much higher and having my anemometer on top of 30 feet of iron tubing on the roof, besides the tall wireless telegraph aerial, was uninjured. Wireless telegraphy is a very useful means of foretelling unsettled thunder weather. For a number of days my instrument has indicated an increasing amount of atmospheric electricity, but now to-night, after the storm, all this has gone, and I am able to receive messages from very long distances with unusual clearness.

A. LANDER.

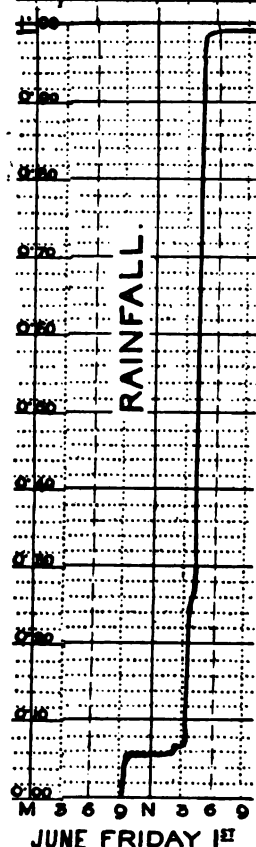
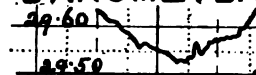
Canterbury, June 1st, 1906.

[Mr. Lander does not state whether an arrangement for melting the hailstones as they fell was attached to his rain gauge, or whether only that part of the precipitation falling as rain is accounted for in the trace.—Ed. S.M.M.]

## THERMOMETER



## BAROMETER



JUNE FRIDAY 1<sup>st</sup>



## TEMPERATURE FOR MAY, 1906.

| STATION.                            | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |        |      |        | No. of Nig-<br>ator below. |      |
|-------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|--------|------|--------|----------------------------|------|
|                                     |                      |            |                      |                                | Max.         |        | Min. |        | Shade.                     | Gra. |
|                                     |                      |            |                      |                                | o.           | Date.  | o.   | Date.  |                            |      |
| Camden Square.....                  | London.....          | 51 32      | 0 8                  | 111                            | 78·9         | 8      | 32·1 | 1      | 0                          | 3    |
| Tenterden.....                      | Kent.....            | 51 4       | 0 41                 | 190                            | 72·5         | 12     | 32·5 | 1      | 0                          | 5    |
| West Dean.....                      | Hampshire.....       | 51 3       | 1 38                 | 137                            | 74·0         | 13     | 29·0 | 2      | 4                          | 7    |
| Hartley Wintney.....                | ".....               | 51 18      | 0 53                 | 222                            | 76·0         | 8      | 28·0 | 2      | 2                          | 5    |
| Hitchin.....                        | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | 75·0         | 8      | 32·0 | 17     | 1                          | ...  |
| Winslow (Addington).....            | Buckinghamsh. r.     | 51 58      | 0 53                 | 309                            | 75·0         | 8      | 30·0 | 2, 18  | 3                          | 5    |
| Bury St. Edmunds (Westley).....     | Suffolk.....         | 52 15      | 0 40                 | 226                            | 73·0         | 28     | 30·0 | 1      | 1                          | ...  |
| Brundall.....                       | Norfolk.....         | 52 37      | 1 26                 | 66                             | ...          | ...    | ...  | ...    | ...                        | ...  |
| Winterbourne Steepleton.....        | Dorset.....          | 50 42      | 2 31                 | 316                            | 71·7         | 13     | 29·0 | 1      | 5                          | 5    |
| Torquay (Cary Green).....           | Devon.....           | 50 28      | 3 32                 | 12                             | 69·1         | 14     | 36·0 | 1      | 0                          | 1    |
| Polapit Tamar [Launceston].....     | ".....               | 50 40      | 4 22                 | 315                            | 70·2         | 13     | 30·1 | 19     | 1                          | 1    |
| Bath.....                           | Somerset.....        | 51 23      | 2 21                 | 67                             | 73·5         | 13     | 30·0 | 2      | 3                          | ...  |
| Stroud (Upfield).....               | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 72·0         | 13     | 35·0 | 1      | 0                          | ...  |
| Church Stretton (Woolstaston).....  | Shropshire.....      | 52 35      | 2 48                 | 800                            | 67·5         | 7, 13  | 27·0 | 2      | 6                          | ...  |
| Bromsgrove (Stoke Reformatory)..... | Worcestershire.....  | 52 19      | 2 4                  | 225                            | 69·0         | 8      | 28·0 | 4      | 2                          | ...  |
| Boston.....                         | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 74·0         | 8      | 32·0 | 2      | 1                          | ...  |
| Workshop (Hodsock Priory).....      | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 72·4         | 8      | 27·3 | 1      | 3                          | 5    |
| Derby (Midland Railway).....        | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 78·0         | 8      | 32·0 | 18     | 1                          | ...  |
| Bolton (Queen's Park).....          | Lancashire.....      | 53 35      | 2 28                 | 390                            | 63·7         | 13     | 35·4 | 2      | 0                          | 5    |
| Wetherby (Ribston Hall).....        | Yorkshire, W.R. .... | 53 59      | 1 24                 | 130                            | ...          | ...    | ...  | ...    | ...                        | ...  |
| Arnccliffe Vicarage.....            | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...    | ...  | ...    | ...                        | ...  |
| Hull (Pearson Park).....            | " E.R. ....          | 53 45      | 0 20                 | 6                              | 70·0         | 27     | 30·0 | 1      | 2                          | 6    |
| Newcastle (Town Moor).....          | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...    | ...  | ...    | ...                        | ...  |
| Borrowdale (Seathwaite).....        | Cumberland.....      | 54 30      | 3 10                 | 423                            | 68·6         | 13     | 30·2 | 1      | 1                          | ...  |
| Cardiff (Ely).....                  | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...    | ...  | ...    | ...                        | ...  |
| Haverfordwest (High Street).....    | Pembroke.....        | 51 48      | 4 58                 | 95                             | 71·6         | 13     | 33·7 | 19     | 0                          | 5    |
| Aberystwyth (Gogerddan).....        | Cardigan.....        | 52 26      | 4 1                  | 83                             | 77·0         | 13     | 30·0 | 18, 19 | 4                          | ...  |
| Llandudno.....                      | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 65·0         | 24     | 36·5 | 2      | 0                          | ...  |
| Cargen [Dumfries].....              | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 69·0         | 13     | 28·0 | 1      | 2                          | ...  |
| Lilliesleaf (Riddell House).....    | Roeburgh.....        | 55 31      | 2 46                 | 550                            | 66·0         | 13     | 28·0 | 4      | 4                          | 5    |
| Edinburgh (Royal Observatory).....  | Midlothian.....      | 55 55      | 3 11                 | 442                            | 62·7         | 27     | 32·5 | 1      | 0                          | 5    |
| Colmonell (Clachanton).....         | Ayr.....             | 55 8       | 4 54                 | 140                            | 68·0         | 27     | 30·0 | 20     | 1                          | ...  |
| Glasgow (Queen's Park).....         | Renfrew.....         | 55 53      | 4 18                 | 144                            | 63·0         | 28     | 30·0 | 1, 2   | 2                          | 15   |
| Tighnabruich.....                   | Argyll.....          | 55 55      | 5 14                 | 50                             | 60·0         | 13, 14 | 30·0 | 1      | 2                          | 3    |
| Mull (Quinish).....                 | ".....               | 56 36      | 6 13                 | 35                             | ...          | ...    | ...  | ...    | ...                        | ...  |
| Dundee (Eastern Necropolis).....    | Forfar.....          | 56 28      | 2 57                 | 199                            | 67·7         | 26     | 29·8 | 1      | 3                          | ...  |
| Braemar.....                        | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...    | ...  | ...    | ...                        | ...  |
| Aberdeen (Cranford).....            | ".....               | 57 8       | 2 7                  | 120                            | 65·0         | 29     | 28·0 | 10     | 5                          | ...  |
| Cawdor (Budgate).....               | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...    | ...  | ...    | ...                        | ...  |
| Invergarry.....                     | E. Inverness.....    | 57 4       | 4 47                 | 1307                           | ...          | ...    | ...  | ...    | ...                        | ...  |
| Loch Torridon (Bendamph).....       | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...    | ...  | ...    | ...                        | ...  |
| Dunrobin Castle.....                | utherland.....       | 57 59      | 3 56                 | 14                             | 59·6         | 6, 7   | 31·5 | 11     | 3                          | ...  |
| Castletown.....                     | Caithness.....       | 58 35      | 3 23                 | 100                            | 64·0         | 8      | 34·0 | 2      | 0                          | 7    |
| Killarney (District Asylum).....    | Kerry.....           | 52 4       | 9 31                 | 178                            | 67·5         | 29     | 32·0 | 1      | ...                        | ...  |
| Waterford (Brook Lodge).....        | Waterford.....       | 52 15      | 7 7                  | 104                            | 68·0         | 13     | 33·0 | 10     | 0                          | ...  |
| Broadford (Hurdlestown).....        | Clare.....           | 52 48      | 8 38                 | 167                            | 67·0         | 28     | 32·0 | 9      | 1                          | ...  |
| Carlow (Browne's Hill).....         | Carlow.....          | 52 50      | 6 53                 | 291                            | ...          | ...    | ...  | ...    | ...                        | ...  |
| Dublin (Fitz William Square).....   | Dublin.....          | 53 21      | 6 14                 | 54                             | 68·9         | 28     | 35·0 | 10     | 0                          | 1    |
| Ballinasloe.....                    | Galway.....          | 53 20      | 8 15                 | 160                            | 67·2         | 13     | 28·0 | 10     | 3                          | ...  |
| Clifden (Kylemore House).....       | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...    | ...  | ...    | ...                        | ...  |
| Crossmolina (Ennisicoe).....        | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...    | ...  | ...    | ...                        | ...  |
| Seaford.....                        | Down.....            | 54 19      | 5 50                 | 180                            | 69·0         | 12     | 32·0 | 1      | 1                          | 4    |
| Londonderry (Creggan Res.).....     | Londonderry.....     | 54 59      | 7 19                 | 320                            | ...          | ...    | ...  | ...    | ...                        | ...  |
| Omagh (Edenfel).....                | Tyrone.....          | 54 36      | 7 18                 | 280                            | 65·0         | 12     | 34·0 | 9      | 0                          | 1    |

## RAINFALL FOR MAY, 1906.

| RAINFALL OF MONTH. |       |                    |          |                   |             | RAINFALL FROM JAN. 1. |       |                      |          | Mean Annual 1870-1899. | STATION.           |
|--------------------|-------|--------------------|----------|-------------------|-------------|-----------------------|-------|----------------------|----------|------------------------|--------------------|
| ver. 0-99.         | 1906. | Diff. from Av. in. | % of Av. | Max. in 24 hours. | No. of Days | Aver. 1870-99.        | 1906. | Diff. from Aver. in. | % of Av. |                        |                    |
| n.                 | in.   |                    |          | in. Date.         |             | in.                   | in.   |                      |          | in.                    |                    |
| 72                 | 1.09  | - .63              | 63       | .36               | 20          | 14                    | 8.54  | 8.59                 | + .05    | 101                    | Camden Square      |
| 72                 | 2.03  | + .31              | 118      | .40               | 20          | 10                    | 9.59  | 11.10                | +1.51    | 116                    | Tenterden          |
| 86                 | 2.49  | + .63              | 134      | .59               | 13          | 16                    | 10.59 | 14.02                | +3.43    | 132                    | West Dean          |
| 79                 | 2.19  | + .40              | 122      | .75               | 8           | 16                    | 9.70  | 10.62                | + .92    | 109                    | Hartley Wintney    |
| 87                 | .99   | - .88              | 53       | .24               | 20          | 15                    | 8.37  | 8.65                 | + .28    | 103                    | Hitchin            |
| 06                 | 1.42  | - .64              | 69       | .27               | 20          | 15                    | 9.29  | 9.32                 | + .03    | 100                    | Addington          |
| 85                 | 1.48  | - .37              | 80       | .44               | 20          | 14                    | 8.28  | 10.48                | +2.20    | 127                    | Westley            |
| 74                 | 4.40  | +2.66              | 253      | 2.46              | 13          | 16                    | 8.23  | 13.78                | +5.55    | 167                    | Brundall           |
| 02                 | 3.73  | +1.71              | 185      | .74               | 23          | 18                    | 14.04 | 19.47                | +5.43    | 139                    | Winterbourne Stptn |
| 96                 | 1.53  | - .43              | 78       | .40               | 22          | 15                    | 12.92 | 13.40                | + .48    | 104                    | Torquay            |
| 98                 | 2.30  | + .32              | 116      | .34               | 5           | 21                    | 13.33 | 18.58                | +5.25    | 139                    | Polapit Tamar      |
| 09                 | 1.81  | - .28              | 87       | .29               | 16          | 16                    | 10.72 | 11.09                | + .37    | 103                    | Bath               |
| 10                 | 2.03  | - .07              | 97       | .31               | 23          | 16                    | 10.60 | 10.89                | + .29    | 103                    | Stroud             |
| 62                 | 2.08  | - .54              | 79       | .30               | 2           | 20                    | 11.85 | 11.56                | - .29    | 98                     | Woolstaston        |
| 94                 | 2.08  | + .14              | 107      | .36               | 3           | 15                    | 8.50  | 9.04                 | + .54    | 106                    | Bromsgrove         |
| 73                 | 1.24  | - .49              | 72       | .30               | 20          | 11                    | 7.82  | 8.48                 | + .66    | 108                    | Boston             |
| 01                 | 1.38  | - .63              | 69       | .34               | 19          | 17                    | 8.57  | 8.15                 | - .42    | 95                     | Hodsock Priory     |
| 96                 | 1.65  | - .31              | 84       | .29               | 26          | 16                    | 8.78  | 9.61                 | + .83    | 109                    | Derby              |
| 46                 | 4.14  | +1.68              | 168      | .59               | 8           | 24                    | 13.54 | 20.91                | +7.37    | 155                    | Bolton             |
| 90                 | 2.80  | + .90              | 147      | .80               | 19          | 21                    | 9.25  | 10.99                | +1.74    | 119                    | Ribston Hall       |
| 36                 | 7.08  | +3.72              | 211      | 1.05              | 19          | 23                    | 22.78 | 31.27                | +8.49    | 137                    | Arncliffe Vic.     |
| 95                 | 1.80  | - .15              | 92       | .55               | 7           | 16                    | 9.12  | 8.53                 | - .59    | 94                     | Hull               |
| 89                 | 4.78  | +2.89              | 253      | 1.90              | 19          | 23                    | 9.32  | 11.08                | +1.74    | 119                    | Newcastle          |
| 26                 | 16.10 | +8.84              | 222      | 3.03              | 25          | 26                    | 50.39 | 58.84                | +8.45    | 117                    | Seathwaite         |
| 55                 | 5.06  | +2.51              | 198      | 1.25              | 26          | 22                    | 14.66 | 21.25                | +6.59    | 145                    | Cardiff            |
| 53                 | 4.88  | +2.35              | 193      | 1.29              | 5           | 23                    | 17.06 | 20.41                | +3.35    | 120                    | Haverfordwest      |
| 44                 | 4.10  | +1.66              | 168      | .80               | 26          | 23                    | 14.66 | 21.15                | +6.49    | 144                    | Gogerdan           |
| 85                 | 3.24  | +1.39              | 175      | 1.22              | 8           | 19                    | 10.18 | 14.31                | +4.13    | 141                    | Llandudno          |
| 60                 | 7.00  | +4.40              | 269      | 1.36              | 19          | 17                    | 16.07 | 17.90                | +1.83    | 111                    | Cargen             |
| 07                 | 5.80  | +3.73              | 280      | .77               | 8, 19       | 27                    | 11.44 | 12.74                | +1.30    | 111                    | Riddell House      |
| ...                | 4.53  | ...                | ...      | .58               | 23          | 21                    | ...   | 11.43                | ...      | ...                    | Edinburgh          |
| 50                 | 4.89  | +2.39              | 196      | 1.02              | 19          | 18                    | 16.12 | 17.05                | + .93    | 106                    | Colmonell          |
| 36                 | 3.92  | +1.56              | 166      | .50               | 27          | 24                    | 12.24 | 16.29                | +4.05    | 133                    | Glasgow            |
| 21                 | 7.22  | +4.01              | 225      | 1.06              | 28          | 19                    | 20.89 | 29.23                | +8.34    | 140                    | Tighnabruaich      |
| 91                 | 4.40  | +1.49              | 151      | .72               | 18          | 19                    | 20.29 | 21.49                | +1.20    | 106                    | Quinish            |
| 88                 | 5.00  | +3.12              | 266      | .80               | 24          | 21                    | 9.94  | 9.75                 | - .19    | 98                     | Dundee             |
| 29                 | 5.45  | +3.16              | 238      | ...               | ...         | ...                   | 12.50 | 16.64                | +4.14    | 133                    | Braemar            |
| 20                 | 5.37  | +3.17              | 244      | 1.23              | 16          | 23                    | 11.60 | 13.21                | +1.61    | 114                    | Aberdeen           |
| 03                 | 3.41  | +1.38              | 168      | .63               | 8           | 23                    | 9.68  | 13.33                | +3.65    | 138                    | Cawdor             |
| 84                 | 4.16  | +1.32              | 147      | .45               | 3           | 18                    | 21.87 | 25.28                | +3.41    | 116                    | Invergarry         |
| 05                 | 7.10  | +2.05              | 141      | 1.40              | 18          | 25                    | 31.26 | 43.26                | +12.00   | 138                    | Bendamp            |
| 02                 | 4.50  | +2.48              | 223      | .85               | 24          | 18                    | 11.31 | 17.77                | +6.46    | 157                    | Dunrobin Castle    |
| ...                | 3.31  | ...                | ...      | .67               | 31          | 22                    | ...   | 17.20                | ...      | ...                    | Castletown         |
| 95                 | 3.70  | + .75              | 125      | .61               | 2           | 23                    | 22.70 | 19.56                | -3.14    | 86                     | Killarney          |
| 11                 | 3.70  | +1.59              | 176      | .53               | 22          | 16                    | 14.58 | 15.40                | + .82    | 106                    | Waterford          |
| 09                 | 3.55  | +1.46              | 170      | .59               | 4           | 16                    | 11.60 | 15.45                | +3.85    | 133                    | Hurdlestown        |
| 35                 | 2.86  | + .51              | 122      | .42               | 26          | 19                    | 12.71 | 13.33                | + .62    | 105                    | Carlow             |
| 94                 | 2.47  | + .53              | 127      | .50               | 19          | 20                    | 9.93  | 11.59                | +1.66    | 117                    | Dublin             |
| 49                 | 3.70  | +1.21              | 149      | .60               | 3           | 23                    | 13.23 | 16.60                | +3.37    | 126                    | Ballinasloe        |
| 61                 | 5.56  | + .95              | 121      | .76               | 2           | 22                    | 28.96 | 30.49                | +1.53    | 105                    | Kylemore House     |
| 93                 | 4.32  | +1.39              | 147      | .54               | 1           | 24                    | 18.79 | 23.25                | +4.46    | 124                    | Ennisceoe          |
| 45                 | 4.12  | +1.67              | 168      | .76               | 19          | 20                    | 14.20 | 14.20                | .00      | 100                    | Seaforde           |
| ...                | 2.50  | ...                | ...      | .20               | 10          | 25                    | ...   | 10.00                | ...      | ...                    | ...                |

## SUPPLEMENTARY RAINFALL, MAY, 1906.

| Div.  | STATION.                          | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | 1.88            | XI.    | Rhayader, Tyrmynydd .....         | 4.82            |
| „     | Ramsgate, West Cliff Villas ..... | 2.80            | „      | Lake Vyrnwy .....                 | 2.83            |
| „     | Hailsham .....                    | 2.39            | „      | Llangyhanfal, Plâs Draw....       | 4.60            |
| „     | Crowborough, Uckfield Lodge ..... | 2.72            | „      | Criccieth, Talarvor.....          | 14.99           |
| „     | Osborne, Newbarn Cottage. ....    | 1.74            | „      | Llanberis, Pen-y-pass .....       | 3.31            |
| „     | Emsworth, Redlands.....           | 2.37            | „      | Lligwy .....                      | 4.73            |
| „     | Alton, Ashdell .....              | 1.73            | „      | Douglas, Woodville .....          | 5.12            |
| „     | Newbury, Welford Park ...         | 1.79            | XII.   | Stoneykirk, Ardwell House .....   | 7.18            |
| III.  | Harrow Weald, Hill House. ....    | 1.48            | „      | Dalry, The Old Garroch ...        | 7.71            |
| „     | Oxford, Magdalen College..        | 1.78            | „      | Langholm, Drove Road.....         | 6.80            |
| „     | Bloxham Grove .....               | 1.67            | „      | Moniaive, Maxwellton House .....  | 5.65            |
| „     | Pitsford, Sedgebrook .....        | 1.30            | XIII.  | N. Esk Reservoir [Penicuik] ..... | 3.90            |
| „     | Huntingdon, Brampton.....         | 1.84            | XIV.   | Maybole, Knockdon Farm..          | 4.38            |
| „     | Wisbech, Bank House .....         | 1.20            | „      | Campbeltown, Witchburn... ..      | 4.88            |
| IV.   | Southend Water Works.....         | 1.87            | XV.    | Inveraray, Newtown .....          | 5.30            |
| „     | Colchester, Lexden .....          | 1.27            | „      | Ballachulish House.....           | 3.80            |
| „     | Newport, The Vicarage.....        | 1.08            | „      | Islay, Eallabus .....             | 6.39            |
| „     | Rendlesham .....                  | 1.25            | XVI.   | Dollar Academy .....              | 6.28            |
| „     | Swaffham .....                    | .83             | „      | Loch Leven Sluice .....           | 4.71            |
| „     | Blakeney .....                    | 2.29            | „      | Balquhiddier, Stronvar .....      | 4.46            |
| V.    | Bishops Cannings .....            | 2.61            | „      | Perth, Pitcullen House.....       | 4.74            |
| „     | Ashburton, Druid House ...        | 3.23            | „      | Coupar Angus Station .....        | 5.17            |
| „     | Okehampton, Oaklands.....         | 2.42            | „      | Blair Atholl.....                 | 6.55            |
| „     | Hartland Abbey .....              | 3.47            | „      | Montrose, Sunnyside Asylum .....  | 5.61            |
| „     | Lynmouth, Rock House ...          | 2.92            | XVII.  | Alford, Lynturk Manse ...         | 2.89            |
| „     | Probus, Lamelllyn .....           | 3.54            | „      | Keith Station .....               | 4.66            |
| „     | Wellington, The Avenue ...        | 2.91            | XVIII. | N. Uist, Lochmaddy .....          | 3.46            |
| „     | North Cadbury Rectory ..          | 4.70            | „      | Alvey Manse .....                 | 5.95            |
| VI.   | Clifton, Pembroke Road .....      | 2.56            | „      | Loch Ness, Drumnadrochit. ....    | 3.24            |
| „     | Moreton-in-Marsh, Longboro' ..    | 1.82            | „      | Glencarron Lodge .....            | 4.76            |
| „     | Ross, The Graig .....             | 1.77            | „      | Fearn, Lower Pitkerrie.....       | 4.20            |
| „     | Shifnal, Hatton Grange.....       | 2.98            | XIX.   | Invershin .....                   | 4.48            |
| „     | Cheadle, The Heath House. ....    | 3.18            | „      | Altnaharra .....                  | 3.75            |
| „     | Coventry, Kingswood .....         | 2.34            | „      | Bettyhill .....                   | 5.10            |
| VII.  | Market Overton .....              | 2.90            | „      | Watten Station .....              | 3.08            |
| „     | Market Rasen .....                | 1.61            | XX.    | Dunmanway, The Rectory..          | 5.55            |
| „     | Bawtry, Hesley Hall .....         | 1.18            | „      | Glenam [Clonmel] .....            | 3.25            |
| VIII. | Neston, Hinderton.....            | 2.15            | „      | Ballingarry, Gurteen .....        | 4.02            |
| „     | Southport, Hesketh Park... ..     | 3.41            | „      | Miltown Malbay.....               | 2.74            |
| „     | Chatburn, Middlewood .....        | 5.02            | „      | Gorey, Courtown House ...         | 4.90            |
| „     | Carmel, Flookburgh .....          | 6.22            | „      | Moynalty, Westland .....          | 3.79            |
| IX.   | Langsett Moor, Up. Midhope ..     | 3.12            | „      | Athlone, Twyford .....            | 3.83            |
| „     | Scarborough, Scalby .....         | 2.72            | „      | Mullingar, Belvedere.....         | 4.76            |
| „     | Ingleby Greenhow .....            | 5.11            | XXII.  | Woodlawn .....                    | 4.80            |
| „     | Mickleton .....                   | 3.39            | „      | Westport, Murriak Abbey..         | 3.59            |
| X.    | Bardon Mill, Beltingham ...       | 4.75            | „      | Collooney, Markree Obsy..         | 3.90            |
| „     | Ewesley, Fallowles .....          | 4.64            | „      | Enniskillen, Portora .....        | 4.11            |
| „     | Ilderton, Lilburn Cottage... ..   | 8.15            | XXIII. | Warrenpoint, Summer Hill. ....    | 4.28            |
| „     | Keswick, York Bank .....          | 6.24            | „      | Banbridge, Milltown .....         | 4.42            |
| XI.   | Llanfrecchfa Grange.....          | 3.81            | „      | Belfast, Springfield .....        | 2.97            |
| „     | Treherbert, Tyn-y-waun ...        | 7.89            | „      | Bushmills, Dundarave .....        | 4.87            |
| „     | Carmarthen, The Friary.....       | 6.12            | „      | Stewartstown, The Square..        | 4.74            |
| „     | Castle Malgwyn [Llechryd]. ..     | 3.82            | „      | Killybegs .....                   | 2.70            |
| „     | Plynlimon .....                   | 8.50            |        |                                   |                 |
| „     | Tall-y-llyn.....                  | 1.70            |        |                                   |                 |
| „     | New Radnor, Ednol .....           | 2.87            |        |                                   |                 |

## METEOROLOGICAL NOTES ON MAY, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—The R was light but fairly frequent and the weather deficient in sunshine, ten days having less than one hour each. Total duration, 124·7\* hours, and duration of R 28·4 hours. The mean temp. was 54°·5, or 0°·5 above the average, but this was chiefly due to a few warm days, since for the greater part of the month cool winds kept the temp. low.

CROWBOROUGH.—Fine but changeable, warm and cold periods alternating. Mean temp. 51°·1. R ·69 in. above the average of 35 years. TS and H on 16th.

HARTLEY WINTNEY.—Cold, stormy and unsettled, with many sunless days and cold N.E. winds. Ozone every day; mean 4·3. TS on 8th.

TORQUAY.—Mean temp. 52°·5, or 0°·6 below the average. Duration of sunshine 185·1\* hours. Mean amount of ozone 5·3.

WELLINGTON.—Variable, but generally cold until the last week. Very violent TS with 1·18 in. of R on 13th. R about 1·25 in. above the normal.

NORTH CADBURY.—By far the wettest May in 10 years. Terrible TS on 13th of 8 hours' duration, over nearly the whole of Somerset and much of Dorset and Wilts. There were upwards of 100 casualties from L, and in this parish cows and trees were struck.

BOLTON.—The cloudiest, wettest and most sunless May on record. Duration of sunshine 59·2\* hours, or 89·1 hours below the average. Mean amount of cloud 9·2.

SOUTHPORT.—Unprecedentedly cloudy and sunless, with heavy R. Mean temp. 50°·4, or 0°·7 below the average. Duration of sunshine 111·9\* hours, or 101 hours below the average and 42 hours below the previous lowest. R 1·31 in. above the average; total duration 72·4 hours.

LILBURN.—Excessive R. Heavy floods on the night of 19th caused great damage, bridges being carried away.

CARMARTHEN.—Unusually wet, cold and stormy, rendering the season generally backward. Abundant fruit blossom, but little prospect of its setting.

DOUGLAS.—Deplorably wet, stormy and cold. The R was exceeded only once in 32 years. High winds or gales occurred almost every day and sunshine was largely deficient.

LILLIESLEAF.—The wettest month registered in 20 years, the R being two and a half times the average.

COUPAR ANGUS.—The most noteworthy feature was the heavy R and the large number of rain days, being the highest in 26 years. The night temp. was high and the day temp. low, the mean being slightly below the average.

ABERDEEN.—Cold with little sunshine and the wettest month for 18 years. Agricultural work was delayed and growth checked.

DRUMADROOCHIT.—R 1·40 in., and rain days 9, above the average of 20 years, and three times exceeded in that period. There has, however, never been so cold and inclement a May.

DUNMANWAY.—The first five days, and from 22nd to 28th, were wet, but from 6th to 21st was fine and dry with cold winds.

CORK.—R ·90 in. above, and mean temp. 2°·7 below, the average.

DARRYNANE ABBEY.—The wettest May in 27 years, the R being 118·5 per cent. above the average of 25 years. There were a few fine warm days in the middle, but the rest was cold and windy.

DUBLIN.—A month in keeping with its predecessors: changeable, cloudy and cold. The mean temp. was 51°·7, or 0°·4 below the average.

OMAGH, EDENFEL.—An exceedingly raw, cold and inclement May, with an unusual preponderance of strong polar winds and R much above the average. Vegetation of all kinds was about three weeks late, but June commenced with a marked improvement.

## Climatological Table for the British Empire, December, 1905.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain. |       | Aver. |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|-------------|-------|-------|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.      | Days. |       |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |      |               |           |                 |                   |             |       |       |
|                                                                  |           |       |          |       |          |      |               |           |                 |                   |             |       |       |
| London, Camden Square                                            | 57.1      | 7     | 29.2     | 12    | 44.5     | 37.1 | 39.2          | 92        | 64.3            | 24.6              | .74         | 7     | 7.9   |
| Malta.....                                                       | 66.4      | 6     | 47.0     | 25    | 62.0     | 51.9 | 50.9          | 85        | 106.6           | 40.6              | 9.10        | 17    | 5.8   |
| Lagos.....                                                       | 91.0      | 16a   | 71.0     | 30    | 86.6     | 75.0 | 74.5          | 76        | 144.0           | 60.0              | .01         | 1     | 3.8   |
| Cape Town ..                                                     | 91.0      | 13    | 46.5     | 2     | 75.9     | 58.1 | 54.3          | 60        | ...             | ...               | .67         | 4     | 3.2   |
| Durban, Natal .....                                              | 90.7      | 18    | 61.6     | 21    | 81.7     | 67.4 | ...           | ...       | 154.2           | ...               | 3.01        | 22    | 6.8   |
| Johannesburg .....                                               | 87.2      | 9     | 45.9     | 20    | 75.7     | 56.0 | 55.9          | 76        | 162.1           | 44.8              | 3.98        | 15    | 4.2   |
| Mauritius.....                                                   | 87.8      | 12    | 62.6     | 24    | 84.5     | 70.9 | 69.6          | 78        | 153.5           | 54.1              | 6.55        | 11    | 6.9   |
| Calcutta.....                                                    | 82.9      | 22    | 51.7     | 19    | 77.9     | 56.4 | 54.8          | 66        | 140.5           | 45.5              | .00         | 0     | 1.5   |
| Bombay.....                                                      | 89.7      | 1     | 61.2     | 31    | 84.9     | 69.4 | 63.3          | 65        | 139.2           | 49.0              | .00         | 0     | 1.8   |
| Madras .....                                                     | 86.2      | 12    | 59.2     | 10    | 83.5     | 67.2 | 66.0          | 76        | 135.9           | 54.9              | .40         | 2     | 3.2   |
| Kodaikanal .....                                                 | 73.3      | 23    | 41.7     | 11    | 66.8     | 47.5 | 37.5          | 51        | 131.1           | 18.5              | .02         | 1     | 3.5   |
| Colombo, Ceylon.....                                             | 91.7      | 23    | 68.5     | 30    | 88.2     | 73.2 | 69.7          | 75        | 150.6           | 64.5              | .48         | 4     | 4.5   |
| Hongkong.....                                                    | 80.4      | 11    | 53.4     | 31    | 69.6     | 62.1 | 59.2          | 80        | 134.0           | ...               | 2.37        | 8     | 7.3   |
| Melbourne.....                                                   | 98.9      | 18    | 47.0     | 28    | 72.1     | 58.1 | 52.0          | 74        | 132.1           | 36.0              | 3.18        | 8     | 5.6   |
| Adelaide .....                                                   | 106.0     | 25    | 45.8     | 5     | 84.1     | 56.7 | 48.9          | 47        | 165.0           | 42.1              | .06         | 3     | 3.4   |
| Coolgardie .....                                                 | 105.4     | 16    | 51.6     | 2     | 93.7     | 63.0 | 52.4          | 40        | 173.6           | 49.0              | 1.20        | 4     | 3.2   |
| Sydney .....                                                     | 84.8      | 10    | 55.8     | 12    | 74.3     | 61.7 | 56.7          | 67        | 129.1           | 46.7              | 2.73        | 19    | 6.3   |
| Wellington .....                                                 | 76.2      | 14    | 41.6     | 25    | 65.1     | 51.6 | 49.6          | 72        | 132.0           | 35.0              | 2.89        | 13    | 5.0   |
| Auckland .....                                                   | 76.0      | 12    | 49.0     | 2, 23 | 67.9     | 55.8 | 53.7          | 76        | 139.0           | 41.0              | 2.96        | 11    | 4.0   |
| Jamaica, Negril Point.....                                       | 88.1      | 6     | 67.1     | 22    | 85.7     | 71.2 | 71.1          | 80        | ...             | ...               | 1.72        | 5     | ...   |
| Trinidad .....                                                   | 88.0      | 9b    | 65.0     | 5c    | 85.5     | 68.6 | 71.0          | 81        | 136.0           | 61.0              | 4.16        | 9     | ...   |
| Grenada.....                                                     | 83.6      | 11    | 70.2     | 4     | 82.0     | 72.9 | 71.6          | 78        | 147.6           | ...               | 5.66        | 20    | 3.8   |
| Toronto .....                                                    | 45.9      | 27    | 6.9      | 15    | 36.8     | 25.7 | 27.8          | 84        | 59.5            | 2.0               | 2.28        | 11    | 8.0   |
| Fredericton .....                                                | 54.8      | 3     | -21.0    | 12    | 33.0     | 10.1 | 11.2          | 67        | ...             | ...               | 3.51        | 11    | 6.1   |
| Winnipeg .....                                                   | 35.4      | 10    | -17.5    | 3     | 21.4     | 1.7  | ...           | ...       | ...             | ...               | .41         | 7     | 4.9   |
| Victoria, B.C. ....                                              | 50.7      | 18    | 27.8     | 31    | 46.1     | 39.1 | ...           | 90        | ...             | ...               | 2.82        | 18    | 8.1   |
| Dawson .....                                                     | ...       | ...   | ...      | ...   | ...      | ...  | ...           | ...       | ...             | ...               | ...         | ...   | ...   |

a and 17, 20, 24. b and 11, 28. c and 21, 24, 29.

MALTA.—Mean temp. of air 56°·2, or 0°·1 above average. Mean hourly velocity of wind 7·5 miles, or 3·6 below average. Mean temp. of sea 64°·5. TSS on 3 days.

MAURITIUS.—Mean temp. of air 0°·8 below, of dew point 1°·9, and E 3·65 in. above, averages. Mean hourly velocity of wind 8·0 miles, or 2·8 miles below average.

MADRAS.—Bright sunshine 223·9 hours.

KODAIKANAL.—Bright sunshine 259 hours.

COLOMBO.—Mean temp. of air 79°·8, or 0°·6 above, of dew point 1°·2 below, and E 5·09 in. below averages. Mean hourly velocity of wind 10·5 miles.

HONGKONG.—Mean temp. of air 65°·3, or 2°·6 above, and E 1·34 in. above, averages. Bright sunshine 117·0 hours, or 68 hours below average. Mean hourly velocity of wind 12·9 miles.

ADELAIDE.—Mean temp. of air 70°·4, or 1°·0 below, and E ·80 in. below averages.

Bright sunshine 23 hours above average.

SYDNEY.—E 23 in. above, mean temp. 1°·9 below, and humidity 1·1 p.c. above averages.

TRINIDAD.—E ·64 in. below 40 years' average.



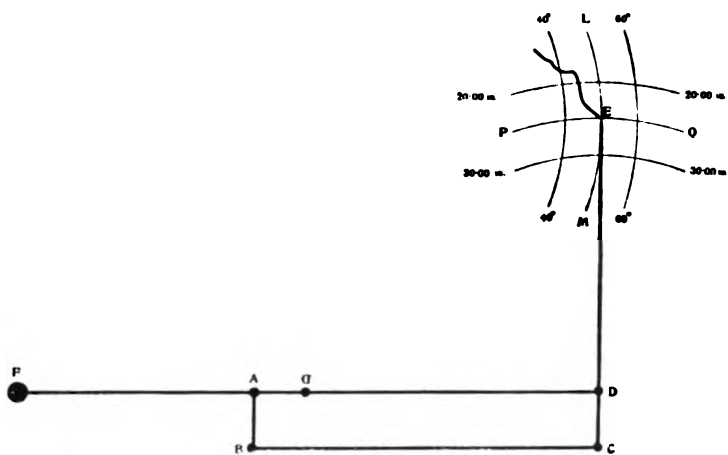


FIG. I.

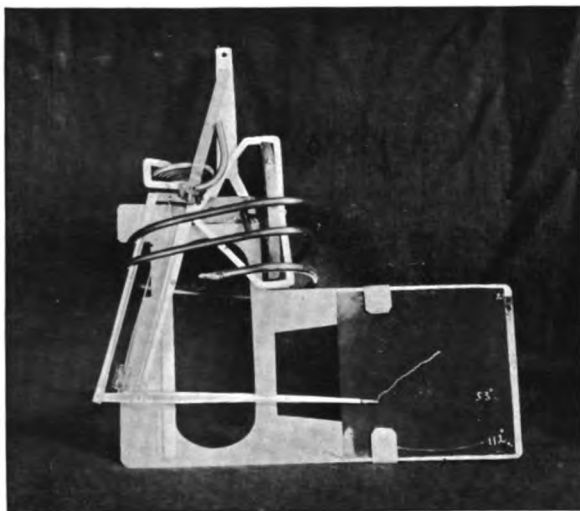


FIG. II.

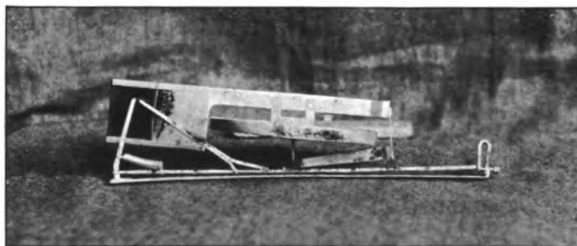


FIG. III  
THE DINES' LIGHT METEOROGRAPHS.

UNIV OF  
CALIFORNIA  
Symons's

# Meteorological Magazine.

No. 486.

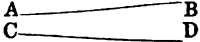
JULY, 1906.

VOL. XLI.

## TWO NEW LIGHT METEOROGRAPHS FOR USE WITH UNMANNED BALLOONS.

By W. H. DINES, F.R.S.

PERHAPS next to accuracy, lightness is the most important characteristic of a meteorograph designed for work with small balloons, and since the clock supplies in general a fair proportion of the weight, an attempt has been made to dispense with the clock. In the heavier of these instruments, which weighs  $3\frac{1}{2}$  oz. (100 grammes), the following plan is adopted. Fig. I. shows the arrangement in diagrammatic form. A, B, C, D, is a parallelogram formed of strips of thin aluminium, freely jointed at the points A, B, C and D. This is pivoted to the frame at A. The rod DA is produced to F and carries a counterpoise at F. The rod CD is continued to E, and ends at E in a turned-down sharp point, which writes on a piece of smoked aluminium and forms the record. The point G is pivoted to the face of an aneroid box, so that G moves backwards and forwards as the atmospheric pressure varies. If B remains fixed the result is that the writing point E describes the arc LM of a circle, and its position on this arc determines the pressure and hence the height. The point B is pivoted to some thermometric arrangement, so that B moves round A as the temperature varies. This causes E to move in an arc PQ and its position on PQ determines the temperature. The motions are quite independent of each other, and consequently the position of the writing point fixes both height and temperature, and the trace it makes gives the relation between them.

In the second and lighter form of instrument, which weighs 1 oz. (28 grammes), the trace is very small, but is read under a low power microscope. This plan was suggested by Dr. W. Watson some time since. The trace is given by two sharp steel points, which scratch a piece of thin metal electro-plated with copper. This plated metal is moved laterally by the extension of an aneroid box and by this motion two scratches like the lines  are produced.

The distance between the two points which make the scratches is

G



regulated by the temperature, and it is quite easy under a microscope to determine the distance between the lines to  $1/2000$  in. ( $1/80$  mm.). Thus the distance measured along the lines gives the height, and the distance between them at that point the corresponding temperature at that height. The thermometric arrangement consists of a round steel rod and a strip of very thin aluminium, both six inches long, and their difference in length, which is multiplied up about 20 times by a lever, produces the varying distance between the scratches. The arrangement permits of the temperature being read to within about half a degree Fahrenheit, since it is not the exact position of the scratch which has to be noted but merely the distance between two scratches which lie within one or two millimetres of each other. Nickel steel, which does not vary in length, might be used, but there is an advantage in using common steel for the following reason: the round steel bar, having a small surface, in proportion to its mass, does not follow any change of air temperature as rapidly as the thin strip of the more expansible aluminium, and consequently the difference in length of the two bars before the steel has time to expand is too great, and too large a change of temperature should be indicated. But the inevitable tendency of all thermometers is to have a sensible lag, and this is to some extent compensated, so that on the whole the arrangement is more sensitive than it would be with one non-expansible metal.

Figures II. and III. are from photographs. In Fig III. the electro-plated metal has been smoked, but only for photographic purposes.

Either instrument will stand a considerable amount of shaking without blurring the trace and may be used with a kite. A hygrometric arrangement to show the humidity is easily added to either.

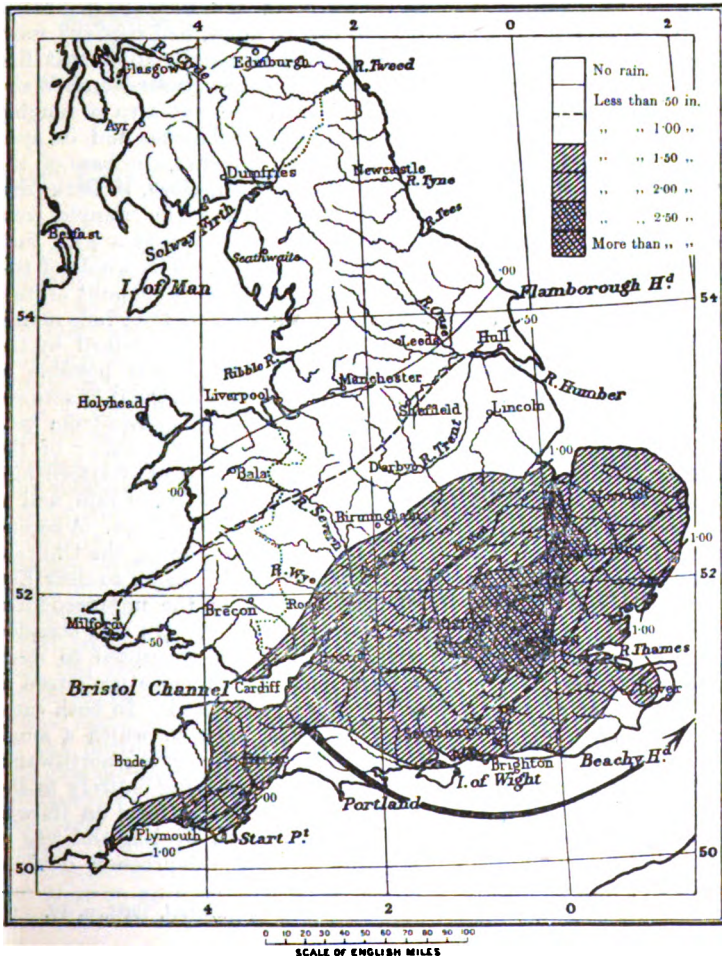
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### THE RAIN OF JUNE 28—29, 1906.

THE month of June usually abounds in interest to the student of local weather, for while it is as a rule the finest month of the year, it seldom passes without severe thunderstorms in different parts of the country. We are embarrassed on this occasion with the richness of our letter-box and have had no little trouble in endeavouring to decide what must be omitted from this number of the Magazine. Heavy summer rain is almost always associated with thunderstorms, and last June was no exception in that respect, the series of storms in the south and west of England, on the 23rd in particular, having produced some remarkable instances, with regard to which we have received many letters. But during last month a comparatively rare phenomenon occurred in the form of a heavy summer cyclonic rain, and as, in our opinion, this was the most remarkable meteorological event which calls for notice, we have discussed it in as great detail as was possible in the limited time and with the necessarily imperfect

data available. An occasion like this, when an incident of weather quite out of the common presents itself, makes us appreciate the trouble which so many observers take in forwarding their daily rainfall readings monthly, but it also makes us feel how much of that trouble is deprived of its chief value (immediate availability) by the delay of a day or two in sending it in. However, the regrets are not much in evidence on this occasion, for the returns, admirably supplemented by special reports from additional observers, were sufficiently numerous to enable us to construct a very satisfactory map, a reduction of which is here reproduced.

**JUNE 28-29, 1906.**



The rain commenced to fall heavily on the night of the 28th, and in London the hour was 0.27 a.m. on the 29th, while it fell steadily and continuous until 11.45 a.m. In most parts of the country affected by this rain the continuous fall stretched across the two rainfall days divided by 9 a.m. on the 29th, although in every case only a small fraction of the total fall came on the second day. In order to deal with the natural unit of the shower, or period of continuous rain, we have added together the rainfall recorded for the 28th and 29th, but though this represents a period of 48 hours practically all the rain fell in 12 consecutive hours.

When the figures are charted and the lines of equal rainfall drawn as in the accompanying map, it is seen that nearly the whole of the south of England up to a line drawn from the Bristol Channel to the Wash, an area of nearly 22,000 square miles, had received more than an inch of rain. The fall diminished rapidly from that line northwards, and stopped entirely at a line drawn from North Wales to the East Riding of Yorkshire. Within the wet area a roughly triangular patch, with its base near the lower Thames and its apex almost on the Wash, had a fall exceeding 2 inches, the base of the triangle measuring about 50 miles from Wallingford, in Berkshire, to Wallington, near Croydon, while the length of the triangle, from Woking to Wisbech, was more than 100 miles; the area with falls over 2 inches measured about 2600 square miles. The whole of this region, with over 2 inches, received in 12 hours an amount of rain equal to that which falls on the average throughout the whole month of June. Thanks to the numerous rain gauges maintained by the Metropolitan Water Board in the Lee Valley, it was possible to delineate the eastern edge of the very wet area with great exactness. It ran almost due north just to the east of the River Lee from near its mouth to Feilde's Weir, in no place entering the valley of the Roding. In the north of Middlesex and south-east of Hertfordshire there was a considerable area with more than 2.50 in. of rain, and at one point, Muswell Hill, the amount almost reached 3.00 in. A second area with more than 2.50 in. lay as a narrow strip along the Chiltern Hills from Maidenhead to Hitchin and extended thence to near Ely.

The similarity of this distribution to that of the unprecedented June cyclonic rainfall in 1903\* is very striking. On that occasion the fall was continuous for nearly 60 hours and amounted to more than 4.00 in. in the wettest part, but though more prolonged it was of the same type as that now being considered. In both cases the first two days of the heavy fall were those in which a small depression passed through the English Channel, curving northwards on its eastward way with the area of heavy fall lying entirely to the left of the path. In June, 1906, the depression passed on its way over the Continent and the rain in the south of England was of short duration, whereas in 1903 the path of the depression doubled

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\* See this Magazine, vol. 38, p. 97; also *British Rainfall*, 1903, p. 19.

back in a loop through England, keeping up the heavy rainfall on its left-hand side over the same area as had been deluged on its outward way.

The statement that the heavy rain was on the left-hand side of the path of a depression moving eastward, is equivalent to saying that it fell with a prevailing easterly or north-easterly wind, and this was the case on June 28th and 29th, the reduction of temperature being scarcely less remarkable than the heavy rainfall.

The following are some of the heaviest falls recorded :—

| STATION.                        | June 28th.*<br>in. | June 29th.<br>in. | TOTAL.<br>in. |
|---------------------------------|--------------------|-------------------|---------------|
| Hedsor .....                    | 2·66               | ·14               | 2·80          |
| Muswell Hill .....              | 2·90               | ·08               | 2·98          |
| Broxbourne .....                | 2·30               | ·40               | 2·70          |
| Throcking .....                 | 2·25               | ·25               | 2·50          |
| Wendover (Halton Gardens) ..... | 2·63               | ·05               | 2·68          |
| Ely (Stretham) .....            | 2·24               | ·56               | 2·80          |

## THE RAINFALL OF JUNE AND OF THE FIRST HALF OF 1906.

A GREAT deal of time is spent both by Observers and Editor in preparing the elaborate table of monthly rainfall given on the last page but three of each number of this Magazine; but, although all the facts which it is possible to put forward are set forth there in full without a superfluous letter or figure, the information is too concentrated for the taste of many readers, and it has to be diluted with a number of harmless but really unnecessary words before it can be assimilated with pleasure. June, 1906, would have been perhaps the driest month of the year but for the secondary depression referred to in the foregoing article, which deluged the country within 150 miles of the path of its centre on the left-hand side. It is only in the area of the heavy fall of June 28th--29th that the average monthly rainfall was reached, and in the heart of it, in the north of Buckinghamshire, in Bedfordshire and Cambridgeshire, the excess was more than 50 per cent. Outside a line drawn from Portland Bill through Bristol, Birmingham and Lincoln to the North Sea, the average was nowhere exceeded, and it appears that the whole of Scotland north of the Firths of Forth and Clyde and the whole north of Ireland had less than half the average rainfall, while in the north-east of Scotland only from one-third to one-quarter of the average amount was recorded. The result was that the eastern Midlands were the wettest part of the country, absolutely as well as relatively, and the Highlands and the north of Ireland were the driest.

\* Most of the rain allocated to the rainfall day of June 28th really fell in the early hours of the 29th.

The effect of the June rainfall was to bring the whole country well over the average for the half year. Part of the south of Ireland, a few stations in the south-east of Scotland and a very narrow strip in the English Midlands extending from the Humber to the Severn, had just less than the average fall for the six months, but the rest of the country continued to show a moderate excess. The exceptional dryness of Scotland and Ireland in June did something to mitigate the effects of the very wet May, while in England and Wales the wetness of the south was rather more than counter-balanced by the dryness of the north. Thus the result of the six months' rainfall is to show a general excess of 16 per cent. in England and Wales, 13 per cent. in Scotland, 8 per cent. in Ireland, and 14 per cent. for the British Isles as a whole. This means that there is considerably more than a month's rainfall in hand, if one can use an expression of the counting-house in dealing with the half-unknown economy of Nature.

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## DR. W. N. SHAW ON THE CIRCULATION OF THE ATMOSPHERE.

(CONCLUDED.)

The fourth of Dr. Shaw's recent lectures on Meteorology, delivered at the University of London, is summarised as follows:—

IV.—Variations from normal conditions of atmospheric circulation may be studied by two distinct methods. The first, or geographical method, is that of comparing the variations of any element simultaneously at different parts of the globe, and the second that of studying the sequence of conditions over a period of time at a single locality.

Of these, the former was illustrated by curves exhibiting an obvious relation between the winter rainfall at Thorshavn (Faroe Islands) with that of the preceding summer at St. John's, Newfoundland, and that of the following summer at Berlin. The curve of barometric pressure from year to year at Bombay was shown to be conspicuously similar to those at Cordoba and Santiago inverted, indicating a reciprocal or inverse relation. Again, the seasonal variation curve of Trade-Wind velocity at St. Helena runs parallel to that for rainfall in the south of England. The Trade-Wind may be looked upon as the main artery of atmospheric circulation, and the rainfall as the direct result of that circulation.

In this connection, Dr. Shaw stated that there begin to be signs of many associations on these lines, such, for example, as Captain Lyons's discovery of the connection between Nile floods and rainfall conditions in Abyssinia, but the laws governing these correlations are at present largely matters of speculation. They, however, serve as examples of the geographical association of meteorological phenomena.

Turning to the second method, that of attempting to discover the laws governing the sequence of events in any one part of the globe, it was remarked that the effect of combined meteorological influences may be excellently summed up by observation of the wheat-crops of the British Isles. The yield of wheat is more than accidentally connected with the amount of rain falling during the previous autumn, and Dr. Shaw has made a detailed study of the conditions which precede good and bad wheat crops, with striking results. Plotting the autumn rainfall alone, the inverted curve from 1886 to 1905 follows that of the yield of wheat per acre over the Eastern Counties in almost every year, but, although the autumn rainfall is undoubtedly the predominating factor, it is not the only one. If the five best wheat crops in 20 years, with an average yield of 34·4 bushels per acre, are considered, it is found that the requisite conditions are a warm and dry autumn, a moderate or mild winter with average rainfall, a cold and rather wet spring, and a dry summer with normal temperature. The five worst years, averaging 26·3 bushels per acre, required conditions almost exactly reversed: a wet autumn, colourless as regards temperature, a cold wet winter, warm dry spring and hot summer with average rainfall.

It is a fact, not without significance, that in 16 of the 21 years considered, the departure from the average of the rainfall of the spring and the autumn of the preceding year were in opposite directions.

With regard to the periodic recurrence of meteorological conditions, the state of motion of the atmosphere, regarded as the result of the combined movements of the Earth in relation to the sun, may be considered as stable rather than unstable, that is, with a tendency to revert to a previous state in preference to diverging more widely from that state as the result of temporary disturbing influences. For this reason variations in the circulation indicate variations in the factors causing that circulation, and periodic changes in these factors would have a corresponding influence on the circulation. To become conspicuous, however, these periods must be "in tune."

By combining the sine curves of four component oscillations of respectively 1, 2, 3 and 4 wave lengths over a period of eleven years, the third curve being inverted, a resultant curve is obtained which shows a remarkable analogy with the smoothed wheat-yield curves. It is probable that wheat has a variation with a period of eleven years and perhaps a few months. This period would probably be found to relate also to rainfall, temperature, etc., but with an individual element the resemblance is apt to be masked, whereas the wheat-yield combines the effects of all.

In conclusion, Dr. Shaw reverted to the need for considering the meteorology of the British Isles as an integral part of that of the whole globe, rather than regarding this country as a separate meteorological province and studying it as such.

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

## COLD WEATHER AND ATLANTIC ICE.

THE coldness of the past spring has been rather freely attributed to the prevalence of ice in the North Atlantic. From a rough estimate, based on ice reports, the amount of ice in the north-western portion of that ocean during May would have stood in about the same proportion to that expanse of water as would a cube of ice with sides of 640 ft., exposed and submerged, in the western half of the English Channel, to the water in that area.

What effect could such a relatively small amount of ice have upon the temperature of land even within a radius of a quarter of a mile?

It is the cold Labrador current which lowers the temperature of the western Atlantic, the current from the north which brings the ice rather than the ice itself; and this lowering of temperature has undoubtedly its effect upon the climate of north-western Europe. But it seems probable that the cold periods which occur in this country during the months of April and May are due to the increased activity of the Greenland current, consequent upon the failure of the warm Atlantic Stream to reach, in those months, its average north-eastern limits.

To the westward of our Islands in April and in May the current usually sets to the southward or south-westward, and in the latter month the Atlantic Stream cannot be traced to a more north-easterly position than  $47^{\circ}$  N.,  $27^{\circ}$  W.

This annual failure of the Atlantic Stream may be related to the fact that during February and March the average northern limit of the South-East Trade Wind lies very little north of the equator. In consequence the mean velocity of the Gulf Stream should be lower during these months than at other periods of the year and, presumably, would pour a smaller volume of warm water into the North Atlantic Ocean for some weeks immediately following.

CAMPBELL HEPWORTH.

*Ealing, 26th June, 1906.*

## COLOUR OF LIGHTNING.

SOMERSET has recently been visited by two widespread thunderstorms of exceptional severity. The first storm, on May 13th, lasted for 8 hours. It moved slowly from S.S.W. to N.N.E., beginning here at 3.30 p.m. The thunder and lightning were continuous over the whole area for the whole 8 hours, and the casualties from lightning ran into hundreds, very impartially distributed. The rain was very unequal, almost *nil* to S. and S.W. of Yeovil, but

quite tremendous to E.N.E. of the Mendip Hills, and exceeding an inch over a large district.

The second storm, on June 23rd, moved even more slowly from W.S.W. to E.N.E. I heard thunder, continuously increasing, for three good hours before the storm broke here at 9.15 p.m. Its violence lasted till 11 p.m., and for two short spells the rain was quite exceptionally heavy. This storm, like the first, became more and more terrible as it proceeded, and it would be hard to say which was the worse of the two. But as regards the character of the lightning, the two storms were in very marked contrast.

On May 13th the lightning was *red* throughout, during the heaviest of the rain, before the rain and after it, both while it was high day and after dark. Though very terrible to see, it had little illuminating power; one could *look* at "the red-hot chains flung across the sky," and it seemed to impart its own colour to the objects lit up by it. But on June 23rd, though the lightning shewed red at 7.30, while it was yet at a distance, from the time that the storm broke here, it was of a dazzling steely *blue*. The whole sky was brilliantly lighted up by it, but there was no *looking* at this lightning. Yet all things were shewn up by its pale glare in their own colours. One had time to see and distinguish between flowers and leaves, and I noticed particularly the yellow green of my lawn.

The extreme redness of the lightning in the one case, and its blueness in the other, are noticed again and again in the many reports that I have seen of these storms. Can any explanation be given of this contrast? H. A. BOYS, F.R.Met.Soc.

*North Cadbury Rectory, July 3rd, 1906.*

#### APRIL, 1906, IN NEW SOUTH WALES.

THE month of April, 1906, possessed such abnormal temperature features in New South Wales, that a brief note may be of interest to your readers.

Unseasonably warm weather had been experienced throughout the month, and during the Easter holidays what might be termed a hot wave passed slowly over our State; its duration being most remarkable for the month of April. The following consecutive readings were recorded at the Sydney Observatory:—

|            | April 13th. | 14th. | 15th. | 16th. | 17th. | 18th. | 19th. |
|------------|-------------|-------|-------|-------|-------|-------|-------|
| Temp. .... | 76°·8       | 79°·0 | 87°·2 | 85°·0 | 81°·2 | 88°·0 | 84°·6 |

Taking the mean temperature for the whole of this month at the Observatory, we find that all previous records, extending back to the year 1859, have been eclipsed. The mean for the month just ended was 67°·7, which is 3° in excess of the normal, and 0°·5 higher than the previous next highest mean, *i.e.*, 67°·2, which was the mean for April, 1897. Taking the average of all maximum readings, the



abnormal character of the heat becomes still more apparent. The average max. for the month just ended was  $75^{\circ}\cdot 8$ , or  $4^{\circ}\cdot 9$  above the normal, and  $1^{\circ}\cdot 2$  higher than the previous next highest average maximum, i.e.,  $74^{\circ}\cdot 6$  in April, 1897.

Following is a table showing the means for April, 1906, compared with the result for previous years, at Sydney Observatory:—

|                                                      | Mean Temp.          | Mean Max.           | Mean Min.           |
|------------------------------------------------------|---------------------|---------------------|---------------------|
| April, 1906.....                                     | $67^{\circ}\cdot 7$ | $75^{\circ}\cdot 8$ | $59^{\circ}\cdot 6$ |
| Average for previous 47 years                        | $64^{\circ}\cdot 7$ | $70^{\circ}\cdot 9$ | $58^{\circ}\cdot 3$ |
| Excess of 1906 over average<br>for previous 47 years | $3^{\circ}\cdot 0$  | $4^{\circ}\cdot 9$  | $1^{\circ}\cdot 3$  |

Unseasonably high temperatures for this month have also been experienced in the other Australian States.

We have noticed by the cablegrams published in the Sydney daily papers that a similar heat visitation was experienced in parts of Great Britain about the same time as our heat-wave here, above noted.

H. M. HUNT, Acting Meteorologist.

*Meteorological Branch, Sydney Observatory, May 3rd, 1906.*

## REVIEWS.

*Die Niederschläge in den Norddeutschen Stromgebieten.* [Precipitation in the North German River Basins.] In amtlichen Aufträge bearbeitet von PROFESSOR DR. G. HELLMANN. In drei Bänden. Size  $10\frac{1}{2} \times 7$ . Pp. Vol. 1, vi. + 386 + (140). Vol. 2, viii. + 722. Vol. 3, viii. + 872. Plates. Berlin: Dietrich Reimer (Ernst Vohsen). 1906.

THIS is a remarkable and unique work, consisting of a collection of all the rainfall statistics for Germany printed in full as regards monthly totals, and accompanied by a complete discussion of the general bearing of the data. The period covered is from 1715 to 1891 and the stations are arranged according to the river basins. A map is given of the mean annual rainfall of the German Empire for the ten-year period 1893—1902, based on the records of 3000 stations. It is difficult for any one not conversant with the wearyful details of testing and discussing rainfall data of various origin, observed by different methods, to realize the amount of labour involved in the production of this monument of German Rainfall. It is easy enough to see the vast utility of the work and the extraordinary ability shown in it.

We cannot do more here than congratulate Professor Hellmann on the completion of his herculean task and refer our readers to a detailed article based on these volumes in the forthcoming issue of *British Rainfall*.

*Dix Années d'Observations Météorologiques à Sèvres (Seine-et-Oise). 1892—1901.* Par G. EIFFEL, avec la Collaboration de M. G. BARBÉ. Paris: 1904. Size  $12\frac{1}{2} \times 9\frac{1}{2}$ , pp. 96 + Atlas des Planches.

*Études pratiques de Météorologie et Observations comparées des Stations de Beaulieu, Sèvres et Vacquey pour l'Année 1903. . . . Ibid pour l'Année 1904. . . .* Par G. EIFFEL. Paris: 1905. Size  $12\frac{1}{2} \times 9\frac{1}{2}$ , pp. 378 and 158 + Atlas des Planches.

*Types Généraux de Comparaisons Météorologiques appliqués à l'étude des Stations de Beaulieu-sur-Mer (Alpes Maritimes), Sèvres (près Paris) et Vacquey (Gironde), pour l'Année 1905 (premier Semestre).* Par G. EIFFEL. Paris: 1905. Size  $12\frac{1}{2} \times 9\frac{1}{2}$ , pp. 72.

*Les Observations Courantes en Météorologie et Comparaison des Stations de Beaulieu, Sèvres et Vacquey.* Par G. EIFFEL. Paris: 1905. Size  $7\frac{1}{2} \times 6\frac{1}{2}$ , pp. 44.

THE eminent engineer whose name is associated with the great tower at Paris has given to his meteorological observations at three stations in France a lavish and magnificent embodiment in the series of superb volumes of text, tables and plates the titles of which are given above. Such works could only be produced by a wealthy amateur, and it is pleasant after the usual type of official publication to find so much fresh and spontaneous enthusiasm enshrined in quarto form. Our first thought is that the money expended in the preparation of these volumes might in other directions have produced a greater advancement of the science of meteorology, but probably the second thought is best, which leads us to accept gratefully the object-lesson of Weather Observations made attractive by the charm of liberal space and fine typography.

M. Eiffel strongly advocates the use of recording instruments, though in the case of rainfall he contents himself with the readings of an ordinary gauge twice daily. He groups monthly observations in three "decades," the two first of 10 days, the last of 8, 9, 10 or 11 days, according to the length of the month, preferring these 36 units to the 52 weeks in a year; he also uses the seasonal year from December to November in preference to the civil year for meteorological purposes, a reform which we would gladly see carried out if it were practicable.

## ROYAL METEOROLOGICAL SOCIETY.

THE final meeting of the Session was held on Wednesday afternoon, June 20th, at the Society's Rooms, 70, Victoria Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. F. J. Brodie read a paper on "The Mean Prevalence of Thunderstorms in various parts of the British Isles during the 25 years 1881—1905." The author employed the records from 53 stations, and extracted from them the number of days on which thunderstorms or thunder only were observed. The mean results

for the whole year showed that thunderstorms are most common over inland portions of the northern and eastern counties of England, some places in those districts experiencing between 17 and 19, and one station, Cheadle, in Staffordshire, 22. In London the average annual number is 14. Thunderstorms are least common in the south-western counties, the mean annual number at Cullompton, in Devonshire, being 6, and at Falmouth 4. At some places in the eastern parts both of Ireland and Scotland the number is 8, and locally in the west of Scotland it is even larger. On the west and south coasts of Ireland there are on the average less than 5 thunderstorms per annum, while at most places in the north of Scotland the number is smaller still. Sumburgh Head, in the Shetlands, experiences on the average only one thunderstorm a year. The results for the four seasons of the year show that in all but the winter months the distribution of thunderstorms is very similar to that exhibited by the annual averages, the prevalence being in each case greatest over the northern, eastern, and some parts of the midland counties. In the winter time the distribution is quite different. On the average none of the stations experience 3 thunderstorms in that season, and between one and two are felt only along the extreme western coasts and in the Orkneys. The winter thunderstorms occur most commonly during the passage of large cyclonic disturbances over the Atlantic in proximity to our western coasts, and are experienced at night. The monthly means for the 25 years show that over the greater part of Great Britain thunderstorms are most frequent in July. In several parts of Ireland and the west of Scotland the maximum frequency occurs in June, while in the Scilly Islands and in some parts of the west and north of England it occurs in August.

A paper by Mr. W. H. Dines, F.R.S., on "A Typical Squall at Oxshott, May 25th, 1906," was, in the absence of the author, read by the Secretary. During the morning there was a steady wind from the south-west of over 10 miles per hour until 11.0 a.m., when there was some falling off for fifteen minutes, then a rise to over 20 miles per hour, accompanied by a sudden increase of barometric pressure, and a fall of a few hundredths of an inch of rain. After the squall the wind dropped suddenly and there was almost a dead calm for about twenty minutes. The author, who was flying a kite at the time, gave some account of the changes in the wind at a considerable altitude above the ground. At 11.26 the squall struck the kite, which was then at a height of 2400 feet. Two minutes later the velocity at the kite had risen to 58 miles per hour, and the wire broke under a strain of 180 lbs. Three minutes later the kite fell at a spot  $2\frac{1}{2}$  miles distant from Oxshott.

A general discussion took place on the papers read at the meeting and also on that by Mr. R. G. K. Lempfert, on "The Development and Progress of the Thunder Squall of February 8th, 1906," which was read at the previous meeting.

Mr. A. Hands, Dr. H. R. Mill, Mr. W. Marriott, Mr. J. Hopkinson, Mr. R. G. K. Lempfert, Mr. F. J. Brodie, and the President took part in the discussion.

The following gentlemen were elected Fellows of the Society, viz.: Mr. E. G. Coutts, Mr. H. T. Jackman, Mr. T. S. Sama Row, and Mr. F. W. Simms.

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## THE METEOROLOGY OF THE FREE ATMOSPHERE.

M. L. TEISSERENC DE BORT, Director of the Observatory for Dynamical Meteorology at Trappes, near Paris, delivered a lecture on the Meteorology of the Free Atmosphere, before the Royal Society of Edinburgh, on the afternoon of May 21st.

The lecturer said that the methods for sounding the atmosphere employed at the present day have been in our possession but a few years. The kite, carrying self-registering apparatus, was introduced by the Americans about fifteen years ago; the sounding balloon dates but twelve years back. The use of balloons, furnished with registering apparatus, was proposed by Lemonnier, a French physicist, at the end of the eighteenth century; but they were actually employed for the first time by the Fathers Renard, and especially by MM. Hermite and Besançon, whose first observations go back to 1893. Observations of great interest had already been made on mountains. To these are now added observations made in air altogether free; and these have taught us much that is new.

The lecturer in the first place discussed the distribution of the barometric pressure at a distance of several thousand metres above the ground; and showed maps in which the isobars at 4000 metres (about  $2\frac{1}{2}$  miles) are calculated from the pressure and temperature on the surface of the Earth. He had carefully verified the fact that the pressure in free air falls in accordance with the barometric formula. For that purpose he determined the heights of a large number of balloons by observing them with two theodolites. On the average the heights thus observed agreed with those deduced from the barometers carried by the balloons to within 2 or 3 millimetres of barometric pressure for a height of 4000 metres.

The maps of the isobars at 4000 metres show that most of the areas of high and of low pressure observed near the ground become effaced as we rise in the air, and give place to a maximum of pressure all round the Earth in the tropical regions, and low pressures at the poles. The average direction of cirrus clouds is in harmony with these conditions.

The first fact which the sounding balloons enabled the lecturer to show with regard to temperature was that, even at a height of several thousand metres above the ground, there is, contrary to what had been thought, a very sensible variation of temperature

from winter to summer ; the range between the coldest and the hottest months is  $16^{\circ}$  F. at 10 kilometres (about 6 miles).

Sounding balloons despatched from the Trappes Observatory enabled the lecturer to prove that, after a certain height, varying from 9 to 14 kilometres (5 to 9 miles), the fall of temperature with height ceases altogether—another fact that was wholly unexpected. The zone where this occurs is called the “isothermal zone,” and is situated, comparatively, near the ground (8 to 9 kilometres in certain places) with low pressures ; but at a greater height (about 12 or 13 kilometres) above high pressure areas. As a general rule, the air is colder in the upper part of an anticyclone than it is at a corresponding height above low pressures ; but the contrary holds at medium heights of about 5 kilometres. The absolutely lowest temperatures are observed near high pressures. A temperature of  $-99^{\circ}$  F. has been observed several times at Trappes, and recently as low as  $-112^{\circ}$  F. in Austria.

Balloon flights made daily for a week or more at a time, in different years and at different seasons, have shown that at intervals of a few days the atmosphere exhibits much greater variations of temperature high up than on the ground. At a height of 11 kilometres variations of  $15^{\circ}$  to  $20^{\circ}$  are often observed at a time when variations of only  $2^{\circ}$  to  $3^{\circ}$  are found near the ground. The lecturer believed that the arrest of the decrease of temperature is connected with the cessation at a certain height of movements of the air having a vertical component, the air then having movements which follow the isobaric surfaces. There is thus no longer any temperature variation due to expansion or compression of the air.

In conclusion, the lecturer showed how cyclones and anticyclones are transformed as we rise in the atmosphere. He demonstrated the interesting fact, proved alike by calculation of the isobars and by the flight of balloons, that most of the depressions which appear near the ground as complete atmospheric vortices suffer deformation as the height increases, and in their northern part lose themselves in the great polar vortex ; so that, at a certain height (4 to 7 kilometres), east and north-east winds are no longer found to the north of a depression, and the isobars at this height form a handle attached to the low-pressure areas of northern latitudes. On the front of a depression its characters remain distinct to the top ; a sheaf of ascending air reaches the height of cirrus cloud, and then spreads over the barometric maxima to east and south-east.

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## METEOROLOGICAL NEWS AND NOTES.

AN EARTHQUAKE SHOCK was experienced in South Wales and in various parts of the south and west of England on the morning of June 27th, and several of our correspondents have been kind enough to send particulars of their observations regarding it. On account of the pressure on our space we are unable to print these letters in the present number; and in order that the facts they contain should be put to the best use, we have forwarded them to Dr. C. Davison, of Birmingham, who is dealing fully with the matter.

MR. H. H. CLAYTON, whose work at the Blue Hill Observatory is well known to our readers, has, we learn from *Science*, accepted the position of Professor in the United States Weather Bureau at Washington.

A METEOROLOGICAL EXHIBIT FOR NEW ZEALAND, prepared by the Meteorological Office, was shown at a reception by Dr. W. N. Shaw on July 6th. An account of the exhibit will be given next month.

A METEOROLOGICAL EXHIBITION was arranged by the Royal Meteorological Society, at the request of the Council of the Royal Horticultural Society, which, realizing the great importance of the study of meteorology by those engaged in horticulture, desired to have the subject brought forward at their Great Summer Show, which was held at Holland House, Kensington, on July 11th and 12th. Mr. W. Marriott gave a short address on Meteorology in relation to Gardening, each afternoon during the Show.

RAIN-MAKING IN CANADA.—It is almost incredible that the Legislature of Yukon Territory have voted public money to supplement a popular subscription to induce a notorious "rain-maker" from California to produce rain in the Klondike region this summer. The matter has been brought up in the Dominion Parliament at Ottawa, where the facts were stated and very proper sentiments expressed. When it is so difficult to obtain a few hundred pounds for serious research in meteorology, it is exasperating to find a government within the British Empire throwing away thousands in futile experiments.

"RAIN-MAKING AND SUNSHINE" is the title of a little book which showed unconsciously how enthusiasm for a subject, apart from scientific training, may lead an intelligent mind deplorably astray. The following note is from the *Standard* of May 28th:—

The funeral took place at Shanklin, on Saturday, of Mr. John Collinson, of Delphi Cliff House, who, some time ago, gained considerable local notoriety as the "rainmaker," through his alleged power to regulate the elements, which at times caused him to be subjected to a good deal of chaff. He was the author of a book entitled "Rainmaking and Sunshine," exhaustively discoursing on odyllic force, closing with the hope that this remarkable power might, in course of time, be thoroughly understood and properly valued, and that it might be used and developed for the benefit of the British nation and British Empire.

## TEMPERATURE FOR JUNE, 1906.

| STATION.                          | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |        |      |       | No. of Nights<br>at or below 32° |        |
|-----------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|--------|------|-------|----------------------------------|--------|
|                                   |                      |            |                      |                                | Max.         |        | Min. |       | Shade.                           | Grass. |
|                                   |                      |            |                      |                                | °            | Date.  | °    | Date. |                                  |        |
| Camden Square.....                | London.....          | 51 32      | 0 8                  | 111                            | 80·9         | 20     | 39·8 | 5     | 0                                | 0      |
| Tenterden.....                    | Kent.....            | 51 4       | 0 41                 | 190                            | 79·0         | 21     | 38·0 | 5     | 0                                | 0      |
| West Dean.....                    | Hampshire.....       | 51 3       | 1 38                 | 137                            | 77·0         | 23     | 34·0 | 5     | 0                                | 6      |
| Hartley Wintney.....              | ".....               | 51 18      | 0 53                 | 222                            | 80·0         | 23     | 36·0 | 5, 6  | 0                                | ...    |
| Hitchin.....                      | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | ...          | ...    | ...  | ...   | ...                              | ...    |
| Winslow (Addington).....          | Buckinghamsh. ....   | 51 58      | 0 53                 | 309                            | 79·0         | 20     | 33·0 | 5     | 0                                | ...    |
| Bury St. Edmunds (Westley) ..     | Suffolk.....         | 52 15      | 0 40                 | 226                            | 80·0         | 22     | 35·0 | 5     | 0                                | ...    |
| Brundall.....                     | Norfolk.....         | 52 37      | 1 26                 | 66                             | ...          | ...    | ...  | ...   | ...                              | ...    |
| Winterbourne Steepleton.....      | Dorset.....          | 50 42      | 2 31                 | 316                            | 73·5         | 9      | 36·3 | 6     | 0                                | 1      |
| Torquay (Cary Green).....         | Devon.....           | 50 28      | 3 32                 | 12                             | 71·2         | 9      | 44·5 | 30    | 0                                | 0      |
| Polapit Tamar [Launceston] ..     | ".....               | 50 40      | 4 22                 | 315                            | 74·9         | 13     | 37·4 | 30    | 0                                | 0      |
| Bath.....                         | Somerset.....        | 51 23      | 2 21                 | 67                             | 76·5         | 23     | 39·5 | 6     | 0                                | 0      |
| Stroud (Upfield).....             | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 80·0         | 23     | 46·0 | 30    | 0                                | ...    |
| Church Stretton (Wooltaston) ..   | Shropshire.....      | 52 35      | 2 48                 | 800                            | 75·0         | 23     | 36·0 | 30    | 0                                | ...    |
| Bromsgrove (Stoke Reformatory) .. | Worcestershire.....  | 52 19      | 2 4                  | 225                            | 77·0         | 23     | 36·0 | 30    | 0                                | ...    |
| Boston.....                       | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 77·0         | 20     | 36·0 | 5     | 0                                | ...    |
| Worksop (Hodsock Priory).....     | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 78·9         | 12     | 33·2 | 6     | 0                                | 2      |
| Derby (Midland Railway).....      | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 81·0         | 12     | 38·0 | 5     | 0                                | ...    |
| Bolton (Queen's Park).....        | Lancashire.....      | 53 35      | 2 28                 | 390                            | 71·7         | 23     | 42·4 | 2     | 0                                | 0      |
| Wetherby (Ribston Hall).....      | Yorkshire, W.R. .... | 53 59      | 1 24                 | 130                            | ...          | ...    | ...  | ...   | ...                              | ...    |
| Arncliffe Vicarage.....           | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...    | ...  | ...   | ...                              | ...    |
| Hull (Pearson Park).....          | E.R. ....            | 53 45      | 0 20                 | 6                              | 78·0         | 20     | 35·0 | 6     | 0                                | 2      |
| Newcastle (Town Moor).....        | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...    | ...  | ...   | ...                              | ...    |
| Borrowdale (Seathwaite).....      | Cumberland.....      | 54 30      | 3 10                 | 423                            | 78·7         | 10     | 43·5 | 3     | 0                                | ...    |
| Cardiff (Ely).....                | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...    | ...  | ...   | ...                              | ...    |
| Haverfordwest (High Street) ..    | Pembroke.....        | 51 48      | 4 58                 | 95                             | 74·4         | 9      | 42·0 | 30    | 0                                | 0      |
| Aberystwyth (Gogerddan).....      | Cardigan.....        | 52 26      | 4 1                  | 83                             | 80·0         | 23     | 37·0 | 3, 18 | 0                                | ...    |
| Llandudno.....                    | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 75·0         | 23     | 46·2 | 1     | 0                                | ...    |
| Cargen [Dumfries].....            | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 80·0         | 12     | 40·0 | 30    | 0                                | ...    |
| Lilliesleaf (Riddell House).....  | Roxburgh.....        | 55 31      | 2 46                 | 550                            | 75·0         | 9      | 37·0 | 4     | 0                                | ...    |
| Edinburgh (Royal Observatory) ..  | Midlothian.....      | 55 55      | 3 11                 | 442                            | 75·1         | 12     | 41·8 | 5     | 0                                | 0      |
| Colmonell (Clachantou).....       | Ayr.....             | 55 8       | 4 54                 | 140                            | 76·0         | 11     | 38·0 | 3     | 0                                | ...    |
| Glasgow (Queen's Park).....       | Renfrew.....         | 55 53      | 4 18                 | 144                            | 76·0         | 11     | 41·0 | 3     | 0                                | 1      |
| Tighnabruaich.....                | Argyll.....          | 55 55      | 5 14                 | 50                             | 72·0         | 11     | 36·0 | 3     | 0                                | 0      |
| Mull (Quinish).....               | ".....               | 56 36      | 6 13                 | 35                             | 63·0         | 23     | ...  | ...   | ...                              | ...    |
| Dundee (Eastern Necropolis).....  | Forfar.....          | 56 28      | 2 57                 | 199                            | 83·1         | 12     | 36·7 | 29    | 0                                | ...    |
| Braemar.....                      | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...    | ...  | ...   | ...                              | ...    |
| Aberdeen (Cranford).....          | ".....               | 57 8       | 2 7                  | 120                            | 77·0         | 19     | 43·0 | 4     | 0                                | ...    |
| Cawdor (Budgate).....             | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...    | ...  | ...   | ...                              | ...    |
| Invergarry.....                   | E. Inverness.....    | 57 4       | 4 47                 | 130?                           | ...          | ...    | ...  | ...   | ...                              | ...    |
| Loch Torridon (Bendamph).....     | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...    | ...  | ...   | ...                              | ...    |
| Dunrobin Castle.....              | Sutherland.....      | 57 59      | 3 56                 | 14                             | 70·0         | 21     | 34·0 | 29    | 0                                | 0      |
| Castletown.....                   | Caitness.....        | 58 35      | 3 23                 | 100                            | 73·0         | 19, 21 | 41·0 | 2, 18 | 0                                | ...    |
| Killarney (District Asylum) ..    | Kerry.....           | 52 4       | 9 31                 | 178                            | 78·5         | 11     | 40·0 | 4     | 0                                | ...    |
| Waterford (Brook Lodge).....      | Waterford.....       | 52 15      | 7 7                  | 104                            | 76·0         | 9      | 40·0 | 4     | 0                                | ...    |
| Broadford (Hurdlestown).....      | Clare.....           | 52 48      | 8 38                 | 167                            | 74·6         | 10, 11 | 38·0 | 29    | 0                                | ...    |
| Carlow (Browne's Hill).....       | Carlow.....          | 52 50      | 6 53                 | 291                            | ...          | ...    | ...  | ...   | ...                              | ...    |
| Dublin (Fitz William Square)..... | Dublin.....          | 53 21      | 6 14                 | 54                             | 76·2         | 21     | 42·7 | 30    | 0                                | 0      |
| Ballinasloe.....                  | Galway.....          | 53 20      | 8 15                 | 160                            | 76·3         | 9      | 33·0 | 30    | 0                                | ...    |
| Clifden (Kylemore House).....     | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...    | ...  | ...   | ...                              | ...    |
| Crossmolina (Enniscooe).....      | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...    | ...  | ...   | ...                              | ...    |
| Seaforde.....                     | Down.....            | 54 19      | 5 50                 | 180                            | 81·0         | 8, 10  | 41·0 | 4, 29 | 0                                | 0      |
| Londonderry (Creggan Res.).....   | Londonderry.....     | 54 59      | 7 19                 | 320                            | ...          | ...    | ...  | ...   | ...                              | ...    |
| Omagh (Edenfel).....              | Tyrone.....          | 54 36      | 7 18                 | 280                            | 78·0         | 11     | 36·0 | 29    | 0                                | 1      |

## RAINFALL FOR JUNE, 1906.

| RAINFALL OF MONTH. |       |                    |          |                   |             |                | RAINFALL FROM JAN. 1. |                      |          |     |        | Mean Annual 1870-1899. | STATION. |
|--------------------|-------|--------------------|----------|-------------------|-------------|----------------|-----------------------|----------------------|----------|-----|--------|------------------------|----------|
| ver. 10-99.        | 1906. | Diff. from Av. in. | % of Av. | Max. in 24 hours. | No. of Days | Aver. 1870-99. | 1906.                 | Diff. from Aver. in. | % of Av. |     |        |                        |          |
| in.                | in.   | in.                | in.      | Date.             |             | in.            | in.                   | in.                  | in.      | in. |        |                        |          |
| 09                 | 2.89  | + .80              | 138      | 2.21              | 28          | 8              | 10.63                 | 11.48                | + .85    | 108 | 25.16  | Camden Square          |          |
| 96                 | 1.19  | - .77              | 61       | .33               | 28          | 8              | 11.55                 | 12.29                | + .74    | 106 | 28.36  | Tenterden              |          |
| 02                 | 22.1  | + .19              | 109      | .89               | 28          | 6              | 12.61                 | 16.23                | + 3.62   | 129 | 29.93  | West Dean              |          |
| 89                 | 2.07  | + .18              | 110      | 1.38              | 28          | 7              | 11.59                 | 12.69                | + 1.10   | 109 | 27.10  | Hartley Wintney        |          |
| 89                 | ...   | ...                | ...      | ...               | ...         | ...            | 10.26                 | ...                  | ...      | ... | 24.66  | Hitchin                |          |
| 99                 | 3.68  | + 1.69             | 185      | 2.02              | 28          | 9              | 11.28                 | 13.00                | + 1.72   | 115 | 26.75  | Addington              |          |
| 04                 | 3.37  | + 1.33             | 165      | 1.46              | 28          | 9              | 10.32                 | 13.85                | + 3.53   | 134 | 25.39  | Westley                |          |
| 89                 | 2.00  | + .11              | 106      | .75               | 28          | 15             | 10.12                 | 15.78                | + 5.66   | 156 | 25.40  | Brundall               |          |
| 32                 | 1.71  | - .61              | 74       | .94               | 28          | 7              | 16.36                 | 21.18                | + 4.82   | 129 | 39.00  | Winterbourne Stpltn    |          |
| 13                 | 1.96  | - .17              | 92       | 1.28              | 28          | 7              | 15.05                 | 15.36                | + .31    | 102 | 35.00  | Torquay                |          |
| 12                 | 1.49  | - .63              | 70       | .94               | 28          | 8              | 15.45                 | 20.07                | + 4.62   | 130 | 38.85  | Polapit Tamar          |          |
| 31                 | 2.64  | + .33              | 114      | 1.10              | 28          | 7              | 13.03                 | 13.73                | + .70    | 105 | 30.75  | Bath                   |          |
| 23                 | 2.59  | + .36              | 116      | 1.15              | 28          | 11             | 12.83                 | 13.48                | + .65    | 105 | 29.85  | Stroud                 |          |
| 46                 | 2.14  | - .32              | 87       | .56               | 16†         | 10             | 14.31                 | 13.70                | - .61    | 96  | 33.04  | Woolstaston            |          |
| 07                 | 3.07  | + 1.00             | 148      | .77               | 28          | 8              | 10.57                 | 12.11                | + 1.54   | 115 | 24.50  | Bromsgrove             |          |
| 94                 | 2.33  | + .39              | 120      | .75               | 28          | 12             | 9.76                  | 10.81                | + 1.05   | 111 | 23.30  | Boston                 |          |
| 24                 | 2.15  | - .09              | 96       | .72               | 28          | 10             | 10.81                 | 10.30                | - .51    | 95  | 24.70  | Hodsock Priory         |          |
| 70                 | 2.04  | - .66              | 76       | .54               | 28          | 11             | 11.48                 | 11.65                | + .17    | 101 | 26.18  | Derby                  |          |
| 21                 | 1.86  | - 1.35             | 58       | .33               | 1           | 13             | 16.75                 | 22.77                | + 6.02   | 136 | 42.43  | Bolton                 |          |
| 38                 | .95   | - 1.43             | 40       | .50               | 23          | 7              | 11.63                 | 11.94                | + .31    | 103 | 26.96  | Ribston Hall           |          |
| 69                 | 2.88  | - .81              | 78       | .89               | 12          | 12             | 26.47                 | 34.15                | + 7.68   | 129 | 60.96  | Arncliffe Vic.         |          |
| 12                 | 1.78  | - .34              | 84       | .75               | 21          | 12             | 11.24                 | 10.31                | - .93    | 92  | 27.02  | Hull                   |          |
| 03                 | 1.86  | - .17              | 92       | .55               | 16          | 12             | 11.35                 | 12.92                | + 1.57   | 114 | 27.99  | Newcastle              |          |
| 97                 | 4.61  | - 2.36             | 66       | 2.61              | 26          | 10             | 57.36                 | 63.45                | + 6.09   | 111 | 132.68 | Seathwaite             |          |
| 53                 | 2.33  | - .20              | 92       | .90               | 28          | 11             | 17.19                 | 23.58                | + 6.39   | 137 | 42.81  | Cardiff                |          |
| 61                 | 2.42  | - .19              | 93       | .78               | 27          | 10             | 19.67                 | 22.83                | + 3.16   | 116 | 47.88  | Haverfordwest          |          |
| 93                 | 2.89  | - .04              | 99       | .70               | 23          | 14             | 17.59                 | 24.04                | + 6.45   | 137 | 45.41  | Goggerddan             |          |
| 00                 | 1.41  | - .59              | 70       | .62               | 26          | 9              | 12.18                 | 15.72                | + 3.54   | 129 | 30.98  | Llandudno              |          |
| 68                 | 2.08  | - .60              | 78       | .62               | 23          | 8              | 18.75                 | 19.98                | + 1.23   | 107 | 43.43  | Cargen                 |          |
| 44                 | 1.71  | - .73              | 70       | .33               | 16          | 11             | 13.88                 | 14.45                | + .57    | 104 | 33.04  | Riddell House          |          |
| ...                | 1.50  | ...                | ...      | .86               | 21          | 8              | ...                   | 12.93                | ...      | ... | ...    | Edinburgh              |          |
| 71                 | 1.70  | - 1.01             | 63       | .57               | 21          | 8              | 18.83                 | 18.75                | - .08    | 100 | 44.85  | Colmonell              |          |
| 70                 | 1.61  | - 1.09             | 60       | .32               | 17          | 13             | 14.94                 | 17.90                | + 2.96   | 120 | 35.80  | Glasgow                |          |
| 76                 | 2.20  | - 1.56             | 59       | .83               | 20          | 10             | 24.65                 | 31.43                | + 6.78   | 128 | 57.90  | Tighnabruaich          |          |
| 55                 | 1.30  | - 2.25             | 37       | .38               | 24          | 13             | 23.84                 | 22.79                | - 1.05   | 96  | 57.53  | Quinish                |          |
| 15                 | 1.10  | - 1.05             | 51       | .20               | 21          | 13             | 12.09                 | 10.85                | - 1.24   | 90  | 28.95  | Dundee                 |          |
| 44                 | .77   | - 1.67             | 32       | ...               | ...         | ...            | 14.94                 | 17.41                | + 2.47   | 117 | 36.07  | Braemar                |          |
| 09                 | .74   | - 1.35             | 35       | .17               | 30          | 13             | 13.69                 | 13.95                | + .26    | 102 | 33.01  | Aberdeen               |          |
| 24                 | .80   | - 1.44             | 36       | .28               | 30          | 13             | 11.92                 | 14.13                | + 2.21   | 119 | 29.37  | Cawdor                 |          |
| 85                 | 1.17  | - 1.68             | 41       | .45               | 30          | 4              | 24.72                 | 26.45                | + 1.73   | 107 | 56.00  | Invergarry             |          |
| 78                 | 2.22  | - 2.56             | 46       | .37               | 26          | 13             | 36.04                 | 45.48                | + 9.44   | 126 | 86.50  | Bendamp                |          |
| 14                 | .53   | - 1.61             | 25       | .11               | 21‡         | 7              | 13.45                 | 18.30                | + 4.85   | 136 | 31.60  | Dunrobin Castle        |          |
| ...                | .99   | ...                | ...      | .20               | 27          | 11             | ...                   | 18.19                | ...      | ... | ...    | Castletown             |          |
| 29                 | 3.36  | + .07              | 102      | 1.31              | 17          | 11             | 25.99                 | 22.79                | + 3.20   | 88  | 58.11  | Killarney              |          |
| 61                 | 1.46  | - 1.15             | 56       | .44               | 23          | 14             | 17.19                 | 16.86                | - .33    | 98  | 39.30  | Waterford              |          |
| 52                 | 2.51  | - .01              | 100      | .74               | 17          | 15             | 14.12                 | 17.96                | + 3.84   | 127 | 33.47  | Hurdlestown            |          |
| 32                 | 1.40  | - .92              | 60       | .39               | 23          | 12             | 15.03                 | 14.73                | - .30    | 98  | 34.44  | Carlow                 |          |
| 95                 | 1.05  | - .90              | 54       | .17               | 21          | 12             | 11.88                 | 12.64                | + .76    | 106 | 27.75  | Dublin                 |          |
| 69                 | 2.05  | - .64              | 76       | .40               | 30          | 14             | 15.92                 | 18.65                | + 2.73   | 117 | 37.04  | Ballinasloe            |          |
| 33                 | 4.29  | - 1.04             | 80       | 1.04              | 17          | 7              | 34.29                 | 34.78                | + .49    | 101 | 80.23  | Kylemore House         |          |
| 95                 | 2.44  | - .51              | 83       | .45               | 17          | 13             | 21.74                 | 25.69                | + 3.95   | 118 | 50.50  | Enniscoe               |          |
| 72                 | 1.23  | - 1.49             | 45       | .21               | 16          | 14             | 16.92                 | 15.43                | - 1.49   | 91  | 38.61  | Seaforde               |          |
| 92                 | 1.08  | - 1.84             | 37       | .24               | 19          | 14             | 17.07                 | 21.02                | + 3.95   | 123 | 41.20  | Londonderry            |          |
| 88                 | .91   | - 1.97             | 32       | .30               | 24          | 9              | 15.86                 | 20.49                | + 4.63   | 129 | 37.85  | Omagh                  |          |



## SUPPLEMENTARY RAINFALL, JUNE, 1906.

| Div.  | STATION.                          | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | 2.26            | XI.    | Rhayader, Tyrmynydd .....         | 3.03            |
| „     | Ramsgate, West Cliff Villas ..... | 1.61            | „      | Lake Vyrnwy .....                 | 1.91            |
| „     | Hailsham .....                    | 1.35            | „      | Llangyhanfal, Plás Draw .....     | 1.14            |
| „     | Crowborough, Uckfield Lodge ..... | 2.73            | „      | Criccieth, Talarvor .....         | 2.22            |
| „     | Osborne, Newbarn Cottage .....    | 1.87            | „      | Llanberis, Pen-y-pass .....       | 4.85            |
| „     | Emsworth, Redlands .....          | 1.60            | „      | Lligwy .....                      | 1.44            |
| „     | Alton, Ashdell .....              | 2.18            | „      | Douglas, Woodville .....          | 1.14            |
| „     | Newbury, Welford Park .....       | 3.03            | XII.   | Stoneykirk, Ardwell House .....   | 1.68            |
| III.  | Harrow Weald, Hill House .....    | 2.98            | „      | Dalry, The Old Garroch .....      | 1.64            |
| „     | Oxford, Magdalen College .....    | 2.84            | „      | Langholm, Drove Road .....        | 2.10            |
| „     | Bloxham Grove .....               | 3.25            | „      | Moniaive, Maxwellton House .....  | 1.80            |
| „     | Pitsford, Sedgebrook .....        | 3.81            | XIII.  | N. Esk Reservoir [Penicuik] ..... | 1.65            |
| „     | Huntingdon, Brampton .....        | 3.49            | XIV.   | Maybole, Knockdon Farm .....      | 1.39            |
| „     | Wisbech, Bank House .....         | 3.23            | XV.    | Campbeltown, Witchburn .....      | 1.73            |
| IV.   | Southend Water Works .....        | 2.12            | „      | Inveraray, Newtown .....          | 1.55            |
| „     | Colchester, Lexden .....          | 1.73            | „      | Ballachulish House .....          | 1.68            |
| „     | Newport, The Vicarage .....       | 2.96            | „      | Islay, Ballabus .....             | 1.30            |
| „     | Rendlesham .....                  | 1.93            | XVI.   | Dollar Academy .....              | 1.80            |
| „     | Swaffham .....                    | 2.82            | „      | Loch Leven Sluice .....           | 1.67            |
| „     | Blakeney .....                    | 1.89            | „      | Balquhider, Stronvar .....        | 1.09            |
| V.    | Bishops Cannings .....            | 3.06            | „      | Perth, Pitcullen House .....      | 1.30            |
| „     | Ashburton, Druid House .....      | 2.61            | „      | Coupar Angus Station .....        | 1.27            |
| „     | Okehampton, Oaklands .....        | 1.64            | „      | Blair Atholl .....                | .58             |
| „     | Hartland Abbey .....              | 1.32            | „      | Montrose, Sunnyside Asylum .....  | .77             |
| „     | Lynmouth, Rock House .....        | 2.31            | XVII.  | Alford, Lynturk Manse .....       | .60             |
| „     | Probus, Lamellyn .....            | 1.65            | „      | Keith Station .....               | 1.61            |
| „     | Wellington, The Avenue .....      | 2.32            | XVIII. | N. Uist, Lochmaddy .....          | 1.21            |
| „     | North Cadbury Rectory .....       | 2.15            | „      | Alvey Manse .....                 | .88             |
| VI.   | Clifton, Pembroke Road .....      | 2.74            | „      | Loch Ness, Drumnadrochit .....    | 1.09            |
| „     | Moreton-in-Marsh, Longboro' ..... | 3.46            | „      | Glencarron Lodge .....            | 2.71            |
| „     | Ross, The Graig .....             | 3.09            | „      | Fearn, Lower Pitkerrie .....      | .32             |
| „     | Shifnal, Hatton Grange .....      | 2.36            | XIX.   | Invershin .....                   | .63             |
| „     | Cheadle, The Heath House .....    | 1.97            | „      | Altnaharra .....                  | .93             |
| „     | Coventry, Kingawood .....         | 3.23            | „      | Bettyhill .....                   | 1.04            |
| VII.  | Market Overton .....              | 2.98            | „      | Watten Station .....              | .33             |
| „     | Market Rasen .....                | 1.55            | XX.    | Duumanway, The Rectory .....      | 3.17            |
| „     | Bawtry, Hesley Hall .....         | 1.82            | „      | Cork .....                        | 1.62            |
| VIII. | Neston, Hinderton .....           | 1.21            | „      | Darrynane Abbey .....             | 4.28            |
| „     | Southport, Hesket Park .....      | 1.67            | „      | Glenam [Clonmel] .....            | 1.45            |
| „     | Chatburn, Middlewood .....        | 1.75            | „      | Ballingarry, Gurteen .....        | 2.12            |
| „     | Cartmel, Flookburgh .....         | 3.02            | „      | Miltown Malbay .....              | 2.71            |
| IX.   | Langsett Moor, Up. Midhope .....  | 1.63            | XXI.   | Gorey, Courtown House .....       | 1.65            |
| „     | Scarborough, Scalby .....         | .53             | „      | Moynalty, Westland .....          | 2.13            |
| „     | Ingleby Greenhow .....            | 1.05            | „      | Athlone, Twyford .....            | 1.95            |
| „     | Mickleton .....                   | .67             | „      | Mullingar, Belvedere .....        | 2.22            |
| X.    | Bardon Mill, Beltingham .....     | 1.93            | XXII.  | Woodlawn .....                    | 3.57            |
| „     | Ewesley, Fallowlea .....          | 2.20            | „      | Westport, Murriak Abbey .....     | 3.09            |
| „     | Ilderton, Lilburn Cottage .....   | 1.66            | „      | Collooney, Markree Obay .....     | 2.38            |
| „     | Keswick, York Bank .....          | 1.77            | XXIII. | Enniskillen, Portora .....        | .84             |
| XI.   | Llanfrechfa Grange .....          | 3.87            | „      | Warrenpoint, Summer Hill .....    | ...             |
| „     | Treherbert, Tyn-y-waun .....      | 3.27            | „      | Banbridge, Milltown .....         | 1.02            |
| „     | Carmarthen, The Friary .....      | 2.75            | „      | Belfast, Springfield .....        | 1.31            |
| „     | Castle Malgwyn [Llechryd] .....   | 1.76            | „      | Bushmills, Dundarave .....        | 1.28            |
| „     | Plynlimon .....                   | 4.00            | „      | Stewartstown, The Square .....    | 1.30            |
| „     | Tall-y-llyn .....                 | 1.00            | „      | Killybegs .....                   | 1.77            |
| „     | New Radnor, Ednol .....           | 2.00            | „      | Horn Head .....                   | 1.78            |

## METEOROLOGICAL NOTES ON JUNE, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Fine, with equable temp., except for short cold periods on 1st and 2nd, and 13th to 15th. Mean temp.  $60^{\circ}\cdot 1$ , or  $0^{\circ}\cdot 3$  below the average; the mean temp. exceeded  $70^{\circ}$  on 22nd only. Of the R 76 per cent. took place on the night of 28th and morning of 29th. Moderate T showers on 16th and 23rd. Duration of sunshine  $216^{\circ}\cdot 1$ ,\* and of R  $16^{\circ}\cdot 8$  hours.

CROWBOROUGH.—Fine and warm with considerable sunshine. TSS on 1st, 24th and 29th. R  $\cdot 26$  in. above the average of 35 years. Mean temp.  $56^{\circ}\cdot 8$ .

HARTLEY WINTNEY.—Uninterrupted summerlike weather prevailed throughout, but the heavy R of 28th was followed by cold wind and fall of temp. TSS on 16th and 23rd. Ozone on 9 days; mean 3.1.

ADDINGTON MANOR.—Heavy TSS on 16th and 24th, when seven sheep and two bullocks were killed by L. The R of 28th was the largest in 24 hours since July 17th, 1890, when  $2\cdot 20$  in. fell. Low temp. on 5th, 6th and 30th.

BURY ST. EDMUNDS.—Dry till 25th, with cold nights till 22nd. Heavy cold R on 28th and 29th, measuring  $1\cdot 94$  in. in 12 hours.

TORQUAY.—Duration of sunshine  $261^{\circ}\cdot 9$ \* hours, or  $34\cdot 5$  hours above the average. Mean temp.  $58^{\circ}\cdot 0$ , or  $0^{\circ}\cdot 7$  below the average. Mean amount of ozone 4.6.

NORTH CADBURY RECTORY.—Delightful from 2nd to 23rd, but the last week was cool, cloudy and damp. TS on 23rd and long slow R on 28th.

CLIFTON.—After a cold day with TS on 1st, it was fine and warm till 13th with easterly winds; then rainy and cold till 17th, with TS on 16th. The rest was warmer but unsettled; TS on 23rd and about 30 hours continuous R on 27th and 28th. R  $\cdot 30$  in. above the average.

BOLTON.—Bright and sunny, but duration only  $140^{\circ}\cdot 4$ \* hours, or 17.8 hours below the average. Mean bar. the highest since 1887. Heavy hay crop.

SOUTHPORT.—Remarkably high and steady bar., but singularly normal in nearly all other respects. Mean temp.  $57^{\circ}\cdot 3$ , equal to the average. R  $\cdot 49$  in. below the average. Duration of sunshine  $225^{\circ}\cdot 1$ \* hours, or 4.9 hours above the average. Duration of R  $29\cdot 5$  hours. TSS on 12th, 22nd and 23rd.

CARMARTHEN.—Delightful summer weather till 13th, but afterwards cold, wet and dull to the end. TS on 23rd. Earthquake at 9.48 a.m. on 27th.

HAVERFORDWEST.—Fine and warm with low night temp. and considerable R. Duration of sunshine  $222^{\circ}\cdot 1$ \* hours. Agricultural operations were backward, but crops good. TS on 23rd. Earthquake on 27th.

MULL.—The lack of R did less harm than the dry weather of June, 1905. This month the temp. was much lower and heavy dews and sea fogs were frequent. Never have crops and foliage looked better.

COUPAR ANGUS.—R a little short of the average, but well distributed. Mean temp.  $57^{\circ}\cdot 8$ , the highest in 26 years. Remarkably steady bar.

DUNMANWAY.—The first 16 days were very fine and bright, and warmer than usual. After 16th there was heavy R at night and showers during the day, but it was still warm, except on the last three days.

DARRYNANE ABBEY.—Fine and hot to 16th, but thence almost constant R and fog to 27th. Total R 23 per cent. over the average.

WATERFORD.—The first half was dry, but in the latter part R fell nearly every day. The total was, however, the least since 1889. Mean temp.  $58^{\circ}\cdot 0$ .

MILTON MALBAY.—The first half was warm and sunny with great growth of vegetation. The second half, opening with a TS, had R to the end.

DUBLIN.—Fine with high bar. and marked prevalence of polar winds. The second half was showery. Mean temp.  $59^{\circ}\cdot 1$ , or  $1^{\circ}\cdot 6$  above the average.

OMAGH.—As a rule the month was dry with a considerable preponderance of polar winds, producing on 29th a mean temp. of  $46^{\circ}$ , a point never before reached so late in June during 40 years. Crops, however, suffered but little.

\* Campbell-Stokes.

## Climatological Table for the British Empire, January, 1906.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |       |               |           | Absolute.       |                   | Total Rain. |       | Aver.  |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|-------|---------------|-----------|-----------------|-------------------|-------------|-------|--------|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min.  | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.      | Days. |        |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |       |               |           |                 |                   |             |       | inches | Cloud. |
| London, Camden Square                                            | 53.0      | 26    | 25.3     | 23    | 47.3     | 36.4  | 39.2          | 90        | 79.0            | 22.1              | 4.02        | 18    | 6.3    |
| Malta.....                                                       | 67.2      | 5     | 42.8     | 24    | 50.6     | 49.6  | 48.6          | 82        | 111.0           | 37.7              | 4.48        | 18    | 5.8    |
| Lagos.....                                                       | 91.0      | 6a    | 66.0     | 11b   | 88.0     | 73.4  | 71.3          | 71        | 135.0           | 54.5              | 1.04        | 2     | 0.7    |
| Cape Town .....                                                  | 85.8      | 21    | 51.7     | 18    | 76.7     | 59.1  | 57.2          | 70        | ...             | ...               | .39         | 7     | 3.4    |
| Durban, Natal .....                                              | 97.2      | 11    | 62.8     | 25    | 86.1     | 70.4  | ...           | ...       | 154.8           | ...               | 2.35        | 16    | 6.1    |
| Johannesburg .....                                               | 87.2      | 21    | 51.7     | 26    | 78.9     | 58.2  | 59.0          | 76        | 162.1           | 51.8              | 3.80        | 12    | 3.6    |
| Mauritius.....                                                   | 89.6      | 21    | 65.7     | 6     | 86.1     | 72.6  | 70.2          | 76        | 152.1           | 58.9              | 3.42        | 13    | 6.5    |
| Calcutta.....                                                    | 81.9      | 28    | 46.3     | 17    | 75.9     | 55.8  | 55.2          | 68        | 144.0           | 40.2              | 1.78        | 1     | 3.5    |
| Bombay.....                                                      | 89.0      | 18    | 60.1     | 2     | 82.1     | 66.6  | 61.9          | 67        | 136.6           | 49.0              | .00         | 0     | 1.3    |
| Madras .....                                                     | 86.8      | 10    | 65.1     | 1     | 83.9     | 69.5  | 69.0          | 80        | 138.2           | 60.9              | 4.05        | 5     | 4.8    |
| Kodaikanal .....                                                 | 73.3      | 1     | 41.9     | 13    | 64.8     | 48.1  | 45.0          | 70        | 137.3           | 22.6              | 4.10        | 5     | 3.4    |
| Colombo, Ceylon.....                                             | 89.6      | 20    | 69.2     | 3     | 87.4     | 73.4  | 71.0          | 77        | 156.0           | 63.0              | 6.29        | 9     | 3.9    |
| Hongkong.....                                                    | 72.8      | 10    | 46.8     | 2     | 62.5     | 54.8  | 52.5          | 80        | 123.0           | ...               | 1.99        | 10    | 8.0    |
| Melbourne.....                                                   | 109.6     | 23    | 45.2     | 2     | 81.6     | 56.7  | 53.0          | 59        | 165.8           | 37.2              | .37         | 4     | 4.6    |
| Adelaide .....                                                   | 113.1     | 5     | 51.9     | 27    | 92.4     | 64.4  | 52.7          | 41        | 165.3           | 45.0              | .00         | 0     | 2.4    |
| Coolgardie .....                                                 | 113.0     | 18    | 54.1     | 11    | 96.2     | 66.6  | 52.4          | 37        | 176.0           | 51.2              | .41         | 2     | 3.1    |
| Sydney .....                                                     | 91.0      | 24    | 58.0     | 16    | 77.9     | 64.3  | 61.2          | 69        | 135.4           | 52.5              | 2.21        | 16    | 5.8    |
| Wellington .....                                                 | 75.0      | 20    | 45.0     | 17    | 66.5     | 53.8  | 51.3          | 72        | 138.0           | 40.0              | 4.98        | 9     | 5.9    |
| Auckland .....                                                   | 76.0      | 14    | 52.0     | 3, 24 | 69.1     | 56.3  | 53.5          | 72        | 140.0           | 45.0              | 1.17        | 7     | 4.5    |
| Jamaica, Negril Point..                                          | 89.0      | 6     | 64.0     | 25    | 84.2     | 68.2  | 66.4          | 79        | ...             | ...               | 4.22        | 8     | ...    |
| Trinidad .....                                                   | 89.0      | 16    | 63.0     | 16c   | 82.5     | 64.4  | 67.7          | 77        | 135.0           | 59.0              | .43         | 6     | ...    |
| Grenada.....                                                     | 87.0      | 29    | 69.0     | 26    | 82.0     | 72.0  | 68.6          | 72        | 149.0           | ...               | 2.02        | 13    | 2.6    |
| Toronto.....                                                     | 56.1      | 22    | 4.4      | 8     | 36.9     | 24.4  | 26.0          | 82        | 67.5            | 0.0               | 1.75        | 15    | 7.0    |
| Fredericton .....                                                | 49.8      | 23    | -10.7    | 11    | 31.0     | 10.2  | 8.7           | 63        | ...             | ...               | 4.04        | 9     | 5.6    |
| Winnipeg .....                                                   | 38.5      | 27    | -33.5    | 23    | 17.0     | -3.3  | ...           | ...       | ...             | ...               | 1.33        | 10    | 4.2    |
| Victoria, B.C. ....                                              | 53.1      | 25    | 26.2     | 20    | 45.1     | 38.0  | ...           | ...       | ...             | ...               | 2.56        | 31    | 8.9    |
| Dawson .....                                                     | 18.0      | 31    | -65.5    | 24    | -27.1    | -40.7 | ...           | ...       | ...             | ...               | 1.26        | 10    | 4.9    |

a and 21, 26. b and 12, c and 21.

MALTA.—Mean temp. of air 54°·4, or 1°·3 above average. Mean hourly velocity of wind 10·3 miles, or 1·0 below average. Mean temp. of sea 60°·0.

Durban, Natal.—E 2·39 in. below average.

MAURITIUS.—Mean temp. of air 0°·3 below, dew point equal, and E 4·36 in. below, averages. Mean hourly velocity of wind 9·9 miles, or 1·2 below average.

MADRAS.—E 4·05 in. the heaviest rainfall in January since 1870; TS on 17th, and distant T on 16th and 18th.

KODAIKANAL.—Bright sunshine 217 hours.

COLOMBO.—Mean temp. of air 79°·9, or 0°·8 above, of dew point 1°·0 above, and E 2·66 in. above, averages. Mean hourly velocity of wind 8·4 miles.

HONGKONG.—Mean temp. of air 58°·4. Mean direction of wind E. by N., and mean hourly velocity 12·7 miles. Bright sunshine 86·8 hours.

ADELAIDE.—Mean temp. of air 4°·4 above average. Dry and very hot month.

SYDNEY.—E 1·29 in. below, mean temp. 0°·4 below, and humidity 2·1 below, averages.

WELLINGTON.—Mean temp. 2°·7 below, and E 1·50 in. above, averages.

TRINIDAD.—E 2·49 in. below 43 years' average.

# Symons's Meteorological Magazine.

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## METEOROLOGY AT THE BRITISH ASSOCIATION.

THE British Association for the Advancement of Science held its seventy-sixth annual meeting at York, the city where it met for the first time, and where the Jubilee Meeting was held in 1881. Few towns possess such advantages as York for a meeting of the kind, and the local arrangements both for scientific gatherings and social functions were admirably made. An innovation which was much appreciated was an informal tea-party held every afternoon in the Museum Gardens of the Yorkshire Philosophical Society by the President of that Society, Dr. Tempest Anderson. These gardens contain a well-equipped meteorological station maintained by the Society, the position of which is perfectly adapted for giving a correct record of the climate of York.

Although there was a meeting of the department of Section A for Astronomy and Cosmical Physics, it was not organized this year as a sub-section, with a Chairman, and we cannot but regret the languid interest which continues to be shown by the British Association in Meteorology, and the utterly inadequate time allotted to meteorological papers. It is unfortunate that the few meteorological papers presented to the Association had been announced so late that no abstracts were available for distribution, and useful discussion was thus impossible.

The gathering of meteorologists at the meeting was more remarkable for those who were absent than for those who were present, and yet, considering the opportunities which such a meeting affords for the encouragement and stimulation of observers by contact with the leading exponents of meteorological science, we should naturally expect that some effort would be made by the official Meteorological establishments, to whom all the public money voted for meteorology in this country is confided, to take advantage of them.

The only attempt to bring together those specially interested in the study of atmospheric phenomena was in the Meteorological Breakfast, a spontaneous gathering of meteorological observers and students.

The Breakfast was held in Terry's Restaurant, on Monday, 6th August, at 9 a.m., and for the first time lady-observers were present.

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There was no chairman and no formality, the object being to promote the mutual acquaintance of observers and meteorologists from all parts of the country who have no other opportunity of meeting. It was mentioned that at the previous York meeting in 1881, Mr. Symons held the last of the first series of these breakfasts, which, except for the breakfast given by Dr. Buchan in Edinburgh, in 1892, were not resumed until the first year of the present century, but have since been kept up at Glasgow, Belfast, Southport, Cambridge, Capetown, and now at York. The following is the list of the twenty-eight persons in the order in which their names were signed on entering the room:—

|                        |     |                                  |
|------------------------|-----|----------------------------------|
| Alfred Colson          | ... | Leicester.                       |
| Herbert Ellis          | ... | Leicester.                       |
| John Woodrow           | ... | Paialey (Coats Observatory).     |
| Dr. W. S. Black        | ... | Edinburgh.                       |
| John Smyth, C.E.       | ... | Banbridge.                       |
| Mrs. D. D. MacKinnon   | ... | Speldhurst, Kent.                |
| Patrick Y. Alexander   | ... | Portsmouth.                      |
| John Bolton            | ... | London.                          |
| Dr. H. R. Mill         | ... | London.                          |
| Arthur R. Hinks        | ... | Cambridge Observatory.           |
| Col. A. C. Bigg-Wither | ... | Godalming.                       |
| W. E. Plummer          | ... | Liverpool (Bidston Observatory). |
| Edward Kitto           | ... | Falmouth Observatory.            |
| P. F. S. Amery         | ... | Ashburton.                       |
| J. Smith               | ... | Crathes.                         |
| James Murray           | ... | Edinburgh.                       |
| H. Yule Oldham         | ... | Cambridge.                       |
| A. Macdonald           | ... | Durris, Aberdeenshire.           |
| J. Edmund Clark        | ... | Purley, Surrey.                  |
| James Kewley           | ... | Ile of Man.                      |
| Dr. A. J. Herbertson   | ... | Oxford.                          |
| Mrs. H. R. Mill        | ... | Mill Hill, N.W.                  |
| Miss Rich              | ... | Roedean, Brighton.               |
| Dr. W. J. S. Lockyer   | ... | London.                          |
| Dr. J. R. Ashworth     | ... | Rochdale.                        |
| R. S. Kennedy, C.E.    | ... | London.                          |
| R. Cockburn Millar     | ... | Edinburgh.                       |
| E. P. Frost            | ... | Cambridge.                       |

Later in the day the following papers were taken in Section A:—

*Report of Kites Committee.*

Prof. A. Schuster, F.R.S., and Prof. H. H. Turner, F.R.S.—

*Note on Rainfall.*

Miss C. O. Stevens.—*Telescopic Observations of Meteorological Phenomena.*

J. E. Clark.—*The York Rainfall.*

Dr. W. J. S. Lockyer.—*Some Barometric and Rainfall Changes of an oscillatory nature.*

*Report of Falmouth Observatory Committee.*

*Report of the Ben Nevis Committee.*

These papers, which would have more than filled a day by themselves, were crowded in one day's proceedings along with eight other

papers, one of them a discussion on Radioactivity and the internal structure of the Earth, in which six gentlemen were announced as expected to take part! It is to our mind absurd to overcrowd sections in this way, and it would be far better if the Organizing Committee freely exercised its right of rejecting offered papers, so as to retain no more than can be dealt with fairly in the time allotted.

Apart from the sectional proceedings at the Association, an important place is held by the Conference of Delegates from Affiliated and Associated Societies in all parts of the British Empire. Two meetings of this Conference are held, and the first—at the request of the Committee on Corresponding Societies (President, Sir Edward Brabrook, C.B.; Secretary, Mr. F. W. Rudler, I.S.O.)—an address was given on Local Scientific Societies and Meteorology.

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### LOCAL SOCIETIES AND METEOROLOGY.\*

THE purpose of Scientific Societies is twofold, to advance science and to secure to the members the intellectual advantages which accrue from scientific study. The two aims are inseparable, but one or the other preponderates according to circumstances. While it is evident that a Society devoted exclusively to botany, or to entomology, must look for any development to the wider, or deeper study of the appropriate science, it is no less clear that a field club or local scientific association of a more general kind may be improved by the development of a department hitherto neglected or ignored, and it is to the representatives of societies of the latter category that my remarks are specially addressed. Such societies may be assumed to occupy the mean position in which the advancement of science and the intellectual advantages to the members are blended as equal aims. For the consideration of such societies I would direct attention on this occasion to Meteorology.

It has been suggested at an earlier meeting of this Association that it would be a good thing if all meteorological observations were stopped for a time, and the whole intellectual powers of the observers concentrated on the discussion of a specific problem. This was probably merely a strong way of saying that the aimless reading of instruments and the heaping up of records that are never discussed, are useless and harmful, and in so far I fully agree with it. But I think that meteorology can be advanced best by increasing rather than diminishing the number of observations; though only by insisting that these observations are well-planned and well carried out, mixed, in fact, "with brains."

Meteorology is the science of the atmosphere, as regards its movements and the conditions which bring about those movements. It

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\* Address given to the Conference of Delegates of Corresponding Societies, at the meeting of the British Association at York, by Dr. H. R. Mill.

is not keeping a record of the weather, though that is a necessary part of it, for the central aim of meteorology as a science is to discover the cause and trace the order of those changes which together constitute the weather. It is convenient for the ordinary affairs of life to be able to know in the morning, or the day before, what the weather is going to be, but the sailor or shepherd acquires this power by experience and tradition in a higher degree than a student of meteorology is likely to gain by reading text books, or even an isolated set of instruments.

So far as we can see weather forecasts must always depend on the study of the conditions prevailing simultaneously over a wide area of the Earth's surface, and of the changes these conditions undergo from hour to hour. Such knowledge can only be obtained by government establishments, maintained at great cost, and in telegraphic touch with a far-flung network of stations, reaching beyond our islands on every side. I do not hold out any promise of skill in weather forecasting as a reward for the study of meteorology, but I am sure that the existing weather forecasts would be improved if a large and intelligent public criticism were brought to bear on them. Criticism of the wrong kind abounds; no journalist is too young to fling a gibe at "the Clerk of the Weather;" hundreds of hasty enthusiasts are ready to declare that they could do better themselves. Amongst scientific paradoxers—circle-squarers, Earth-flatteners, perpetual-motionists, and all their kind—I really believe that the worst eminence is held by the weather-cycle-mongers, whose name is legion, for they are many. There is no cure for meteorological fads except the study of meteorological facts, and in the interest of common sense and sane judgment I strongly urge the serious study of meteorology on all who are attracted towards natural science. Sympathetic criticism by students who have taken the trouble to master the principles of weather forecasting, cannot fail to be helpful.

My first advice is never to start meteorological observations with cheap instruments. Enthusiastic weather observers frequently write me wanting to know where they can get a cheap set with which to observe, and my advice is always to wait until they can afford good instruments guaranteed by an official certificate. Imperfect or untrustworthy records are of no value whatever for any purpose. One year's observations are of little value, but they involve a considerable expenditure of time; but a thirty years' record is worth a great deal, and many observers have done as much. Such a record represents some 3000 hours' work, and an observer's time is worth little if it does not represent at least £150. It could easily be made with one set of instruments, and my argument is that it is false economy to render £150 worth of honest work absolutely useless for the sake of saving £5 in the initial cost of equipment. Yet again and again I have met people to whom a few pounds is neither here nor there, who prefer to save five shillings by buying an inferior instrument the record of which is not worth

the time they squander in reading it. It seems to me to be a matter eminently worthy the attention of the delegates whether they will make their societies centres of real scientific work by seeing that however little is done, that little is done well and with appliances that are worth expending time upon.

There is scope in meteorology for a great diversity of useful work suited for various tastes and aptitudes, requiring much or little in the way of equipment. There are some special problems which can only be profitably attacked by trained students. Of these perhaps the most attractive is the study of the conditions of the free atmosphere by means of kites or balloons carrying automatically recording instruments. It is in this department that most advance is now being made, and it promises important developments in meteorological theory. The methods have been developed largely by Mr. W. H. Dines, acting in conjunction with a joint Committee of the British Association and the Royal Meteorological Society, and it would be extremely desirable for the work to be extended. The requisites are a few meteorographs, some powerful kites, several miles of steel wire on which to fly them, and a suitable winding machine with a steam engine for drawing in the kites and controlling their movements. It is absolutely necessary for high flights that the experiments be carried on far from the haunts of men, as if a kite with a couple of miles of steel wire attached were to fall or to break away, disastrous results might follow if there were railways or highroads in its track. Kite work requires an initial expenditure of at least £150, and demands a good deal of mechanical skill as well as scientific enthusiasm on the part of the investigator.

Researches on hygrometry, the condition of the atmosphere as regards water-vapour, are also desirable. For this a good deal could be done with simple means, for the subject remains in a very unsatisfactory state. The relation of the wet and dry bulb thermometer to the hair hygrometer and other direct reading instruments wants to be more fully investigated. The variations of humidity at every hour of the twenty-four wants to be determined for a number of stations in different climates, and the tables for the reduction of the various instrumental readings want to be revised. Success in this research demands some knowledge of physics and mathematics.

The study of local climate may perhaps prove more attractive. Vast masses of observations have been accumulated which have never been utilized and never can be; but this is no reason for ceasing to make observations, quite the reverse. It is extremely desirable that every town of importance should have at least one well-equipped and properly conducted meteorological station. Such stations are maintained as a rule by individuals, though they are sometimes supported by corporations or local authorities, and it seems to me that it would be extremely appropriate for a scientific society to take charge of such an institution, thereby securing the advantages of intelligent oversight and of continuity.

*(To be continued.)*



## THE THUNDERSTORM OF AUGUST 2nd.

THE month of July, during which thunderstorms are usually most numerous in the South of England, passed with fewer storms than were to be expected, but the first week of August showed the familiar electrical disturbances of hot summer weather in the form of sudden and severe thunder squalls in different parts of the country.

It would be difficult to define the individuality of a thunderstorm, or to decide whether the consecutive or simultaneous electrical discharges over a large area of country ought to be referred to as one storm, or as different storms, originating separately and pursuing independent paths, and certainly it would be hopeless to attempt any discussion of the kind with respect to a group of storms occurring in the holiday months, when many observers are from home, and correspondence is greatly delayed. We do not, therefore, attempt any full account of the uneasy weather of the first week of August, but confine ourselves to placing on record a few of the numerous communications sent to us on the subject, some of which give a very graphic account of what occurred.

The thunderstorms of August 2nd were experienced in all parts of the country, and as a rule, while the lightning was intensely vivid and the accompanying rain and hail very severe while they lasted, the duration was short, and few cases of serious damage are reported. After the storm passed a lunar rainbow was seen in many widely separated parts of the country, the contrast of the placid moonlight as the storm-cloud retreated, with the fierceness of the outburst of the short thunder-squall being frequently referred to.

In London the rainfall was comparatively slight, only  $\cdot 12$  in. falling at Camden Square, where the shower lasted for 12 minutes. In other parts of London, however, much heavier falls took place  $\cdot 79$  in. being recorded at Greenwich. The *Daily Telegraph*, in a lively account of the storm, records a humorous incident which we quote:—

“While Lord Hylton was speaking in the House of Lords last night, the thunderstorm burst with a suddenness that caused considerable surprise. The surprise, however, was turned to consternation when, through the open windows, the rain beat in heavily, pattering down upon the heads of the noble lords, many of whom left the Chamber hurriedly to get their hats. Others sought temporary refuge under the galleries. The Lord Chancellor did not weather the storm long, for he at once vacated the Woolsack, leaving Lord Halsbury to preside. The late Lord Chancellor lacking the protection of either wig or hat, anxiously rubbed his head with his hand, as if he seriously felt the inconvenience of the position, for he was unable to seek shelter, and for the occupant of the Woolsack to wear a hat would be a serious breach of the rules of the House. One of the bishops sheltered himself by holding a copy of the Education Bill over his head. Two Liberal lords were heard afterwards to

comment on the fact, one of them remarking that it could not now be denied that the bill had proved a protection to the Church. It was some minutes before the windows were closed. During the incident little attention was paid to the debate, members gathering and chatting together."

The storm appears to have been most severe at Guildford, where the strength of the squall seems to have reached a maximum and wrought great destruction. The remarkable site of the town, in a narrow gap of the North Downs, no doubt intensified the force of the wind. Excellent accounts appeared in the *Surrey Times* and *Surrey Advertiser*. Mr. J. H. Billing, at Maori Road, Guildford, recorded 1·01 in. of rain (including hail) in about 17 minutes. The wind destroyed immense numbers of fine old trees, and most of the damage to houses and structures was due to the fall of trees. Two fatal accidents occurred in this way, and the number of narrow escapes was remarkable.

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The storm which visited the Guildford and Godalming district on the 2nd was so peculiar, that I am sending you cuttings about it from the *Surrey Advertiser*. Here, at Chiddingfold, we appeared to be just on the South-eastern edge of the storm, and felt very little of it, although it was very fierce at Witley, two miles north of us. The clouds in the forenoon were very striking, cirrus of various types: windy, thready, tailed and feathery; and in the feathery there was a remarkably conspicuous ring of cloud, which I suspect was really a spiral. The clouds were at different altitudes, and I should think rather high. About 8.15 p.m. a heavy cloud-bank passed over us, in which red lightning was incessant, darting from cloud patch to cloud patch, but apparently none to earth; and there was no blue lightning, the usual colour of cloud to earth discharges through dry air. The bank came up rather quickly from the south-west, and the greater mass of it passed north-west of us. As far as I could connect flash and report, the distance of the most intense flash, about 8.30 p.m., was 3 miles. As the rear of the bank lifted, about 8.25, the light underneath it showed heavy rain falling to the W.S.W., and we experienced sudden violent puffs of wind; the sound of rain reached us, and we were ready to bolt indoors should it come on, although at the time the rain which we could see was a long way off and not coming towards us, when a heavy spat of rain fell on us quite suddenly, as if a bucket of water had been thrown over us from the passing bank. It did not last long, and the total fall was ·03 in. At 8.45 the storm was passing away, N.E. and S.E., with lightning still playing from cloud to cloud, whilst in the rear it was clearing up fine with little wind but cool air. Mr. Welch's barograph at Cranleigh shows a jump at 8.20 of about a tenth of an inch.

Colonel Godwin-Austen's position at Nore, on the east side of Hascombe Hill, was much more favourable for observing than ours,

as we are surrounded by tall trees. What he says about there being two storms is remarkable; I should be inclined to think that there was one, split into two branches by the Hindhead hills, as I have often seen rain pass S.W. and N.W. of those hills, whilst none fell directly under the lee of them. Doubtless you know that a good illustration of the brush discharge among clouds can be given by tearing wetted cotton wool into separate lumps, and connecting two sides with the terminals of an electric battery; the discharges dart from lump to lump.

J. P. MACLEAR.

*Chiddingfold, Godalming, 11th August, 1906.*

Colonel Godwin-Austen says in the *Surrey Advertiser* :—

“I was induced to make these notes owing to the appearance of the clouds on the westward, the rapidity with which the storm came up, and the rapid changes that took place. The position of Nore is very suitable for such observation, being 400 feet above the sea, and overlooking a great extent of the weald of Sussex.

7—7.30 p.m.—Distant thunder first heard on the west, where a very dense mass of irregular shaped cloud, dark purple in colour, was visible against a clear sky.

8.15.—Two storm centres were apparent. One was far distant in the Horsham direction, and some distance beyond that, probably over the Channel, indicated by a lofty pyramidal mass of cloud, lighted up from time to time by lightning flashes. (This was the storm severely felt at Seaford). The other was close on the west and moving on to the north-west, the southern edge of the clouds being directly above Nore; clear sky south of that, and moon bright.

8.20.—A few large drops of rain fell but soon ceased.

8.25.—Clouds spreading more to the southward, a few scattered drifting across the moon from the south-west. Constant rumble of thunder and much nearer and incessant lightning on the west and north, often at a great height in the clouds, horizontal and ribbon like, and on four occasions from west to east, terminating suddenly and explosively into a cascade of large and small sparks, falling towards the east with the wind.

8.30.—The clouds had reached the southern side of the heavens, and stretched away in a great dark arm to the Downs near Petworth, near where rain could be seen descending in an isolated area. (I have since ascertained this was at Ball's Cross). But there was no lightning on that side. Flashes of lightning appeared very high on the north.

8.40.—The western horizon now clear. Wind rising, gusty, but not strong; storm passing away on the northward, from west to east, parallel to our position, this evidently being on the south edge of the disturbance. Rain beginning and a few scattered hailstones.

8.45.—Very dark and light, sharp-edged clouds to the south, the moon's light behind them adding to the striking effect.

8.50.—All overcast on southward, clear sky to the north-west. Distant thunder now going on to the north-north-east. The rain ceased at this

time; it just wetted the grass slightly. Second storm, lightning far to south-south-east, constant and high up in the clouds.

9.0.—The southern, sharp, defined edge of lofty cloud, passing north-eastward, over the zenith above Nore. The lightning and distant thunder now heard to the eastward.

9.5.—Vivid lightning to the south-east over the weald, with a very distant rumble of thunder not heard by myself. It appeared as if the two storms were meeting some 25 miles to the eastward.

9.10.—Most vivid lightning to the south-east; flashes constant on the east.

9.20.—Bright moonlight and clear sky to the south and west; lightning far away to the eastward.

9.40.—The storm had passed away far beyond Leith Hill, and northward of that elevation. Its position was now indicated by a lofty mass of cloud, and of no great breadth from south to north. It was apparent the area it covered at any one time was very limited, perhaps somewhat longer from west to east than from south to north. After 9.40, with the exception of a few thin scattered clouds coming up from the south-westward the sky was now cloudless.

The storm had a very defined southern edge, leaving the western weald, down to the coast, cloudless and rainless, except for the very partial cloud and rain that passed over Petworth, with a gusty wind.

From the accounts received since, the storm area had an extreme breadth of perhaps 12 miles, for from Nore to Loseley, where the force of the wind was at its maximum, is about six miles. The rain, with hail, only lasted ten minutes, and the storm from commencement to close on westward, reaching its maximum and departure, seemed to be covered in from 25 to 30 minutes.

H. H. GODWIN-AUSTEN."

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A thunderstorm occurred in Surrey on the 2nd August which was remarkable at Haslemere for the rate of rainfall. From 6.30 p.m. beautiful cumulus clouds were passing over from the S.W.; in the N. a most curious fine net-like cloud of graceful form remained some time. At 8 p.m. lightning began in the S.W. and continued constantly, without noticeable intermission, for about an hour. Low growling thunder began about 8.15 and increased in volume, but was never very loud. At 8.30 rain suddenly began in torrents, flooding the lawn in a moment; at 8.38 it ceased quite suddenly—amount measured, .66 in., duration of fall, 8 minutes. This gives a rate of about 4.90 in. per hour. The thunder ceased after the rain, but the lightning continued, now in the N.E., where it came downwards to the earth in lines, occasionally in ordinary flashes. The storm travelled from S.W. to N.E. by way of S. and E. Wind remained S.W. and was of gale force for a few minutes about 8.25. Hail is reported one mile to the S.E., but none fell at Hazelhurst.

T. P. NEWMAN.

*Hazelhurst, Haslemere, Surrey, August 3rd, 1906.*

The following instrumental observations were made during the storm at Epsom :—

| Barometer (uncorrected). |      |     |        | Dry Bulb.                          |      | Wet Bulb. |               |
|--------------------------|------|-----|--------|------------------------------------|------|-----------|---------------|
| 9                        | a.m. | ... | 29.880 | 9                                  | a.m. | ...       | 74.8 ... 66.3 |
| 8                        | p.m. | ... | 29.688 | 7                                  | p.m. | ...       | 77.0 ... 66.0 |
| 8.15                     | "    | ... | 29.670 | 8                                  | "    | ...       | 75.0 ... 65.0 |
| 8.45                     | "    | ... | 29.660 | 9.20                               | "    | ...       | 68.0 ... 66.0 |
| 8.50                     | "    | ... | 29.638 | 10.30                              | "    | ...       | 65.0 ... 64.0 |
| 9                        | "    | ... | 29.650 | Maximum Temperature, 85°·2         |      |           |               |
| 9. 7                     | "    | ... | 29.614 | Rain and hail, 9 p.m. to 9.10 p.m. |      |           |               |
| 10.30                    | "    | ... | 29.612 | Amount = .11 in.                   |      |           |               |

The following are notes of visual observations :—

At 8 p.m. thin veil of cirro-stratus over sky, thunder clouds visible (1) in E. and S.E. (distant thunder had been heard previously in S.E. at 7.15) and (2) in S.W. and W. Wind S.E. to S., force 4, hot gusty puffs. 8.15 p.m., sheet lightning first seen in S.W. 8.20 p.m., sheet lightning continuous in S.W., W., and N.W. 8.25 p.m., fork lightning first seen due W. 8.30 p.m., distant rolling thunder first heard in S.W.; not possible to obtain a time interval owing to lightning being continuous. 8.45 p.m., thunder approaching nearer, continuous sheets of flame in S.W. to W., sheet and fork lightning blinding in its intensity. From 8.30 p.m. to 9 p.m. vivid continuous sheet and fork lightning, accompanied by distant and almost continuous rolling thunder. At 9 p.m. heavy drops of rain commenced, followed at 9.1 p.m. by a hail squall lasting four minutes, and heavy rain to 9.10 p.m.

Wind S.E. to S., force 4, to 9 p.m. (commencement of rain) when a strong squall broke lasting about five minutes, wind going round through S.W. and W. to N.W. and dropping calm.

9.10 p.m., loud thunder crash almost overhead, sheet and fork lightning continuous and very vivid. 9.15 p.m., storm passing away in a N.E. to E. direction, lightning playing all round the sky; sky clearing in W. and S.W., covered with broken pearly white cumulus, stars visible. 9.27 p.m., interval between lightning and thunder, 15 seconds. 9.50 p.m., thunder last heard in N.E. Sheet lightning (reddish to a bluish white) remaining visible in N.E. to E., practically continuous to 11 p.m.

SPENCER C. RUSSELL.

*Epsom, Surrey, August 2nd, 1906.*

At 8.57 p.m. on 2nd inst., a short but very heavy thunderstorm broke over this neighbourhood, accompanied by large hailstones (some of which were 3 inches in circumference) and wind at the force of a gale. At 9.10 p.m. the storm passed away to E.N.E. During the 13 minutes, .33 in. of rain was recorded in a 5 in. gauge with deep funnel.

Considerable damage was done by hailstones and wind to glass, trees, flowers and fruit—apples being cut and bruised. The funnel of a copper Glaisher gauge was dented in several places, and a solar radiation thermometer smashed by the force of the hailstones.

Sheet and forked lightning was almost continuous, being visible from 8.15 to midnight.

W. J. CARTER.

*Edenfield, New Malden, Surrey, 3rd August, 1906.*

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On the evening of the 2nd inst. a thunderstorm was observed approaching from the S.W., the lightning being very vivid.

At 8.45 p.m. the first rain fell, the barometer standing at 29.64 in., the thermometer 71° 5. At 9 p.m. the barometer had *risen* to 29.72, at 9.9 p.m., when the rain ceased, it had *fallen* to 29.66, the thermometer to 66°. The storm lasted only 24 minutes, during which time .40 in. of rain fell, mixed with some hail, the stones measuring over  $\frac{1}{4}$  inch in diameter.

I have never before observed such great fluctuations in the barometer in so short a time.

H. K. G. ROGERS.

*Glenart, Weybridge, 3rd August, 1906.*

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[These fluctuations, a sudden rise followed by a more gradual fall, are familiar in most severe squalls and thunderstorms. The barograph at Camden Square showed this feature in a typical manner on August 2nd.—ED. S.M.M.]

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On Thursday, August 2nd, there was a thunderstorm here at 8 p.m. with .72 in. of rain. Except for a few drops which fell two hours before, the whole of this amount fell in 20 minutes.

CHARLES J. P. CAVE.

*Ditcham Park, Petersfield, August 4th, 1906.*

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A heavy rain in a short period took place here on the evening of August 2nd. .44 in. fell in 9 minutes, and the greater part of it probably came down in about 6. There was a little thunder and a strong wind.

W. M. CHRISTY.

*Watlington, Emsworth, August 4th, 1906.*

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Miss Mary A. Ewart favours us with the following graphic extracts from a letter written to her on August 3rd from Northbrook, Godalming :—

“ We are terribly affected by the awful three minutes' tornado last night. It was quite terrific, coming over from Hindhead and carrying all before it. The lightning came hot and forked, and ran along the paths, and no rain with

it at first; suddenly the hail came—enormous square pieces—then the wind and rain. We rushed to shut the front door, and it took all the strength of three of us to do it, but not before all the hall was strewn with hail. In my bedroom, the bed (16 feet from the window) was covered with hail and the floor white, as both windows were open when the hurricane struck us. Everything was soaked, and the carpet later on was like a pond. The wind made so much noise that we never knew until the hurricane passed over that all the trees, except three, were blown down or stripped of boughs and leaves. All the fine old elms that looked like an avenue down the field are gone, and the dear old oak has its boughs torn off, and snapped on the right side where the gale struck it. Hardly a tree on this high open ground has escaped, and the wrecked look is something too sad for words. The flower borders, which were really perfectly beautiful, are burnt and torn, and desolation under a burning sun is what we look at this morning. Trees are down across the road, and we hardly know where to begin clearing up. The oat crop, which was cut yesterday, is carried away by the wind, the straw shaken and not a grain left, no threshing machine ever equalled the work done by this three minutes of hurricane. It all seems like a bad dream, except that the poor torn stripped trees stare us in the face."

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

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### VIOLENT RAINSTORM AT WEYBRIDGE ON JULY 12th, 1906.

AROUND the hour of 4 p.m. on July 12th, at Weybridge, a heavy thunder-shower characteristic of the season occurred. After the storm the river Thames was much swollen, and I saw the carcass of a pig afloat at Shepperton. I could not ascertain the amount of rain that fell in the district on the afternoon in question, but you will probably be able to state the figures.\* The storm appeared to be heavy towards Surbiton.

The interesting feature of this storm, to my mind, was the light it threw upon the probable immediate cause of these midsummer cloud-bursts. An ascending current of air is generally regarded as the chief cause of the precipitation of rain; it should rather, perhaps, be considered as an essential accompanying condition of such precipitation, which, however, may be called an immediate cause. In the large cyclonic storms of the winter months, the comparatively light intermittent rains that are brought by south-westerly winds in those portions of the atmospheric depressions lying to the right of the paths of the centres may be regarded as the product of the strong

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\* On July 12th the rainfall at Surbiton was 24 in.—ED. S.M.M.

upward movement of the south-westerly winds, but the persistent and heavy "forty-eight hour" rains brought by north-easterly winds in those portions of the depressions lying to the left of the paths of the centres probably involve other additional causes.

Now it seems immensely improbable that heavy thunder rains of the type that occurred at Weybridge on the 12th inst. can be originated by a simple upward current of air even in very warm moist weather without a very much more marked local wind disturbance at the surface than is usually experienced on these occasions. On July 12th the temperature was distinctly low for the season, and the weather though fairly fine was cloudy and gusty all day, having shown a tendency to be showery from the early morning, so that it is even more unlikely that this particular storm owed its sole origin to a local upward convection current. Doubtless, the black cumulo-form clouds which rendered the storm possible, were the product of the ascent of moisture-laden air, and this assumption is borne out by the fact that the storm occurred soon after the warmest part of the day, but the actual deluge was probably occasioned by the impact against the clouds of a cold current of air associated with the peculiar distribution of atmospheric pressure. (Refer to Weather Chart of July 12th for distribution of pressure over England.) At the surface at Weybridge *cold gusts of wind* were persistent all day. The final court of appeal in these cases is, of course, direct observation and experiment; but direct observation and experiment, could kites put the matter to the test, would probably show that upward convection currents *alone* are inadequate to precipitate the destructive rains of the type under discussion.

L. C. W. BONACINA.

*Ide Hill, nr. Sevenoaks, Kent, July 25th, 1906.*

Very different from the storm referred to above were the thunderstorms of the 2nd of August. Towards evening of that date, after a most oppressively hot day, thunderstorms of great intensity were developing "anywhere and everywhere" over the land, and the violent destructive local winds associated with the storms would seem to indicate powerful ascending currents of hot air as the prime cause of the disturbances.

Only on one other occasion, namely during the night of June 11th, 1900, at Clitheroe, Lancashire, have I seen a display of lightning of the same order of magnificence as that at Ide Hill on August 2nd.

At 7 p.m. red discharges were rending the clouds in all directions, and apparently running along their under surfaces from one end to the other; between 8 and 9 p.m. forked lightning of a very severe type prevailed, and there was practically no interval between the flashes.

L. C. W. B.

*Ide Hill, Sevenoaks, August 4th, 1906.*



## THE METEOROLOGICAL OFFICE EXHIBIT.

On July 6th, Dr. W. N. Shaw held a reception in the Meteorological Office, to show the Exhibit which had been prepared in illustration of Methods and Results of Meteorology, for the International Exhibition at Christchurch, New Zealand, to be held in the coming (antipodal) summer. It was largely attended, and the excellent arrangement of the exhibits representative of the meteorological activity of the British Isles was fully appreciated. The view taken by the Meteorological Office in preparing this exhibit was a wide one, and included the various bodies concerned in the study of meteorology, which are unaided by public funds, and untrammelled by government control, justice being thus done to the great army of volunteer Observers and to the Societies which help to maintain the independent status of meteorological science.

The exhibits were grouped in three divisions, which may be briefly summarized :

I.—*The collection and discussion of observations from the ships of H.M. Navy and the Mercantile Marine.* This consisted of sets of instruments exhibited by Messrs. Negretti and Zambra, and Mr. J. J. Hicks, photographs of the placing of the instruments on board ship, specimens of ship's logs, and a set of the publications in which the marine observations are set forth, after being worked up in the Meteorological Office, including the Monthly Meteorological Charts of the North Atlantic and Indian Oceans, various synoptic weather charts, and various charts of winds, currents, and sea-temperatures.

II.—*Telegraphic Reporting. Forecasts and Storm Warnings.* Here were shown a map of the world showing the portions of the globe for which daily weather reports are issued ; a set of instruments, lent by Mr. J. J. Hicks, as used at a telegraphic reporting station ; photographs of meteorological stations and a complete set of the books used in recording and dealing with the telegraphic reports and compiling the Daily Weather Reports. Included with those representing the work of the British Meteorological Office there was an exhibit contributed by Mr. R. F. Stupart, Director of the Canadian Meteorological Office, illustrating the work done in that colony.

III.—*British Meteorological Organizations. Voluntary Stations.* Here Messrs. Negretti and Zambra showed the full equipment of a normal climatological station. The Meteorological Office showed a complete set of the forms used in collecting the data and preparing the Weekly Weather Report, the Monthly Report and the meteorological pages of the Registrar-General's Quarterly Return. The Royal Meteorological Society sent a map showing the Society's stations and specimens of its publications, including the *Quarterly Journal* and *Meteorological Record*. The Scottish Meteorological Society was similarly represented, and so was the British Rainfall

Organization, the map in this case serving to show, not the individual rain gauges, but the comparative density of their distribution over the country. This map is reproduced on a small scale in *British Rainfall*, 1905.

A series of remarkably interesting diagrams illustrating the application of statistics was included in this section, the most attractive being the relations between weather and crops in England. Sir Norman Lockyer showed diagrams illustrating the probable relations between the meteorological conditions in widely distant parts of the Earth, and Mr. F. J. Brodie had a map of the mean annual prevalence of thunderstorms over the British Isles.

IV.—*Observatories (Stations of the First Order) and automatic recording instruments.* Photographs of the standard photographic recording instruments, and examples of various mechanical recording rain-gauges, anemometers and thermographs were shown, together with a very interesting set of records from the various instruments.

In this section also there were models of Mr. Dines's kites, specimens of his meteorographs, and microbarograph, as well as instruments for the observation of clouds.

Considering the value of such an exhibit to the ordinary observer, who has few opportunities of seeing the records of the more costly instruments, and to the general public, we wish that it could be found possible to arrange for permanent collections of the same nature in London and other large towns. The exhibit lent by the Royal Meteorological Society to local scientific societies is a move in the right direction, though it lacks the advantage of permanency.

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## SCOTTISH METEOROLOGICAL SOCIETY.

THE half-yearly meeting of this Society was held in Edinburgh, on the afternoon of July 12th, the Hon. Lord Maclaren in the chair.

Mr. Arthur Watt read a paper on the rainfall of May, 1906, in Scotland, illustrated by maps, showing the average rainfall for May, the distribution of rainfall in May, 1906, when unprecedented falls occurred in many districts, and the distribution of rainfall on two particular days, when heavy falls occurred in different parts of the country. Dr. Knott, Mr. R. T. Omond, Dr. Buchan, and others, took part in the discussion.

Mr. Watt also read a paper on the climate of Hebron, Syria, discussing the ten years' observations made by Dr. Alexander Paterson at that place, and Dr. Paterson contributed an interesting paper of a more general kind on Hebron and its climate, which he said was much the same as the scriptures showed it to have been 3000 years ago.

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## TEMPERATURE FOR JULY, 1906.

| STATION.                           | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[° E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |        |      |          | No. of Nights<br>at or below 2 |       |
|------------------------------------|----------------------|------------|-----------------------|--------------------------------|--------------|--------|------|----------|--------------------------------|-------|
|                                    |                      |            |                       |                                | Max.         |        | Min. |          | Shade.                         | Graw. |
|                                    |                      |            |                       |                                | °            | Date.  | °    | Date.    |                                |       |
| Camden Square.....                 | London.....          | 51 32      | 0 8                   | 111                            | 83·7         | 18     | 45·2 | 1        | 0                              | 0     |
| Tenterden.....                     | Kent.....            | 51 4       | 0 41                  | 190                            | 85·5         | 30     | 43·0 | 2        | 0                              | 0     |
| West Dean.....                     | Hampshire.....       | 51 3       | 1 38                  | 137                            | 80·0         | 30     | 37·0 | 1        | 0                              | 4     |
| Hartley Wintney.....               | ".....               | 51 18      | 0 53                  | 222                            | 80·0         | 18, 23 | 40·0 | 13       | 0                              | ...   |
| Hitchin.....                       | Hertfordshire.....   | 51 57      | 0 17                  | 238                            | 80·0         | 23, 30 | 43·0 | 4        | 0                              | ...   |
| Winslow (Addington).....           | Buckinghamshir.....  | 51 58      | 0 53                  | 309                            | 82·0         | 30     | 43·0 | 1, 21    | 0                              | ...   |
| Bury St. Edmunds (Westley).....    | Suffolk.....         | 52 15      | 0 40                  | 226                            | 85·5         | 30     | 43·0 | 12       | 0                              | ...   |
| Brundall.....                      | Norfolk.....         | 52 37      | * 1 26                | 66                             | ...          | ...    | ...  | ...      | ...                            | ...   |
| Winterbourne Steepleton.....       | Dorset.....          | 50 42      | 2 31                  | 316                            | 75·2         | 4      | 36·4 | 1        | 0                              | 1     |
| Torquay (Cary Green).....          | Devon.....           | 50 28      | 3 32                  | 12                             | 75·6         | 22     | 44·5 | 1        | 0                              | 0     |
| Polapit Tamar [Launceston].....    | ".....               | 50 40      | 4 22                  | 315                            | 74·9         | 22     | 39·4 | 10       | 0                              | 0     |
| Bath.....                          | Somerset.....        | 51 23      | 2 21                  | 67                             | 80·0         | 30     | 43·0 | 12       | 0                              | ...   |
| Stroud (Upfield).....              | Gloucestershire..... | 51 44      | 2 13                  | 226                            | 80·0         | 30     | 50·0 | 108      | 0                              | ...   |
| Church Stretton (Wooltaston).....  | Shropshire.....      | 52 35      | 2 48                  | 800                            | 78·0         | 30     | 39·0 | 1        | 0                              | ...   |
| Bromsgrove (Stoke Newington).....  | Worcestershire.....  | 52 19      | 2 4                   | 225                            | 78·0         | 30     | 37·0 | 13       | 0                              | ...   |
| Boston.....                        | Lincolnshire.....    | 52 58      | 0 1                   | 25                             | 80·0         | 28     | 45·0 | 21       | 0                              | ...   |
| Worksop (Hodsock Priory).....      | Nottinghamshire..... | 53 22      | 1 5                   | 56                             | 80·4         | 30     | 38·7 | 12       | 0                              | 4     |
| Derby (Midland Railway).....       | Derbyshire.....      | 52 55      | 1 28                  | 156                            | 80·0         | 23, 30 | 44·0 | 1        | 0                              | ...   |
| Bolton (Queen's Park).....         | Lancashire.....      | 53 35      | 2 28                  | 390                            | 71·9         | 5      | 45·6 | 13       | 0                              | 0     |
| Wetherby (Ribston Hall).....       | Yorkshire, W.R.....  | 53 59      | 1 24                  | 130                            | ...          | ...    | ...  | ...      | ...                            | ...   |
| Arncliffe Vicarage.....            | ".....               | 54 8       | 2 6                   | 732                            | ...          | ...    | ...  | ...      | ...                            | ...   |
| Hull (Pearson Park).....           | E.R.....             | 53 45      | 0 20                  | 6                              | 81·0         | 28     | 42·0 | 5, 12    | 0                              | 0     |
| Newcastle (Town Moor).....         | Northumberland.....  | 54 59      | 1 38                  | 201                            | ...          | ...    | ...  | ...      | ...                            | ...   |
| Borrowdale (Seathwaite).....       | Cumberland.....      | 54 30      | 3 10                  | 423                            | 73·8         | 4      | 42·9 | 12       | 0                              | ...   |
| Cardiff (Ely).....                 | Glamorgan.....       | 51 29      | 3 13                  | 53                             | ...          | ...    | ...  | ...      | ...                            | ...   |
| Haverfordwest (High Street).....   | Pembroke.....        | 51 48      | 4 58                  | 95                             | 73·6         | 26     | 43·3 | 12       | 0                              | 0     |
| Aberystwyth (Gogerddan).....       | Cardigan.....        | 52 26      | 4 1                   | 83                             | 81·0         | 31     | 35·0 | 11       | 0                              | ...   |
| Llandudno.....                     | Carnarvon.....       | 53 20      | 3 50                  | 72                             | 79·0         | 26     | 49·0 | 3        | 0                              | 0     |
| Cargen [Dumfries].....             | Kirkcudbright.....   | 55 2       | 3 37                  | 80                             | 75·0         | 5      | 40·0 | 11       | 0                              | ...   |
| Lilliesleaf (Riddell House).....   | Roxburgh.....        | 55 31      | 2 46                  | 550                            | 71·0         | 4†     | 40·0 | 8        | 0                              | 0     |
| Edinburgh (Royal Observatory)..... | Midlothian.....      | 55 55      | 3 11                  | 442                            | 69·4         | 26     | 43·7 | 20       | 0                              | 0     |
| Colmonell (Clachanton).....        | Ayr.....             | 55 8       | 4 54                  | 140                            | 73·0         | 5‡     | 38·0 | 11       | 0                              | ...   |
| Glasgow (Queen's Park).....        | Renfrew.....         | 55 53      | 4 18                  | 144                            | 72·0         | 5      | 43·0 | 11       | 0                              | 3     |
| Tighnabruaich.....                 | Argyll.....          | 55 55      | 5 14                  | 50                             | 64·0         | 5, 31  | 39·0 | 20       | 0                              | ...   |
| Mull (Quinish).....                | ".....               | 56 36      | 6 13                  | 35                             | 72·0         | 5      | ...  | ...      | ...                            | ...   |
| Dundee (Eastern Necropolis).....   | Forfar.....          | 56 28      | 2 57                  | 199                            | 79·2         | 22     | 43·3 | 20       | 0                              | ...   |
| Braemar.....                       | Aberdeen.....        | 57 0       | 3 24                  | 1114                           | ...          | ...    | ...  | ...      | ...                            | ...   |
| Aberdeen (Cranford).....           | ".....               | 57 8       | 2 7                   | 120                            | 75·0         | 22     | 42·0 | 8        | 0                              | ...   |
| Cawdor (Budgate).....              | Nairn.....           | 57 31      | 3 57                  | 250                            | ...          | ...    | ...  | ...      | ...                            | ...   |
| Invergarry.....                    | E. Inverness.....    | 57 4       | 4 47                  | 130?                           | ...          | ...    | ...  | ...      | ...                            | ...   |
| Loch Torridon (Bendamph).....      | W. Ross.....         | 57 32      | 5 32                  | 20                             | ...          | ...    | ...  | ...      | ...                            | ...   |
| Dunrobin Castle.....               | Sutherland.....      | 57 59      | 3 56                  | 14                             | 68·0         | 13     | 35·0 | 1        | 0                              | ...   |
| Castletown.....                    | Caithness.....       | 58 35      | 3 23                  | 100                            | 70·0         | 29     | 43·0 | 2        | 0                              | 0     |
| Killarney (District Asylum).....   | Kerry.....           | 52 4       | 9 31                  | 178                            | 74·0         | 23     | 48·0 | 29       | 0                              | ...   |
| Waterford (Brook Lodge).....       | Waterford.....       | 52 15      | 7 7                   | 104                            | 74·0         | 22     | 42·0 | 4        | 0                              | ...   |
| Broadford (Hurdlestown).....       | Clare.....           | 52 48      | 8 38                  | 167                            | 73·0         | 21     | 46·0 | 10\|\| | 0                              | ...   |
| Carlow (Browne's Hill).....        | Carlow.....          | 52 50      | 6 53                  | 291                            | ...          | ...    | ...  | ...      | ...                            | ...   |
| Dublin (Fitz William Square).....  | Dublin.....          | 53 21      | 6 14                  | 54                             | 76·5         | 22     | 47·4 | 4        | 0                              | 0     |
| Ballinasloe.....                   | Galway.....          | 53 20      | 8 15                  | 160                            | 72·5         | 21     | 42·0 | 3, 4, 12 | 0                              | ...   |
| Clifden (Kylemore House).....      | ".....               | 53 32      | 9 52                  | 105                            | ...          | ...    | ...  | ...      | ...                            | ...   |
| Crossmolina (Ennisceoe).....       | Mayo.....            | 54 4       | 9 18                  | 74                             | ...          | ...    | ...  | ...      | ...                            | ...   |
| Seaforde.....                      | Down.....            | 54 19      | 5 50                  | 180                            | 81·6         | 22     | 43·0 | 11       | 0                              | 0     |
| Londonderry (Creggan Res.).....    | Londonderry.....     | 54 59      | 7 19                  | 320                            | ...          | ...    | ...  | ...      | ...                            | ...   |
| Omagh (Edenfel).....               | Tyrone.....          | 54 36      | 7 18                  | 280                            | 75·0         | 31     | 37·0 | 11       | 0                              | ...   |

Hitchen (June)..... Hertfordshire..... 51 57 | 0 17 | 238 | 76·0 | 23 | 35·0 | 4 | 0 | ...

† and 21, 29. ‡ and 26, 30. § and 12, 20 || and 18, 28.

## RAINFALL FOR JULY, 1906.

| RAINFALL OF MONTH. |                    |          |                   |       |             | RAINFALL FROM JAN. 1. |       |                      |          |     | Mean Annual 1870-1899. | STATION.               |
|--------------------|--------------------|----------|-------------------|-------|-------------|-----------------------|-------|----------------------|----------|-----|------------------------|------------------------|
| 1906.              | Diff. from Av. in. | % of Av. | Max. in 24 hours. |       | No. of Days | Aver. 1870-99.        | 1906. | Diff. from Aver. in. | % of Av. | in. |                        |                        |
|                    | in.                |          | in.               | Date. |             | in.                   | in.   |                      |          |     |                        |                        |
| 1                  | .61                | -1.88    | 24                | .21   | 26          | 7                     | 13.12 | 12.09                | -1.03    | 92  | 25.16                  | Camden Square          |
| 2                  | .43                | -1.83    | 19                | .15   | 11          | 9                     | 13.81 | 12.72                | -1.09    | 92  | 28.36                  | Tenterden              |
| 3                  | .44                | -2.18    | 17                | .24   | 18          | 9                     | 15.23 | 16.67                | +1.44    | 109 | 29.93                  | West Dean              |
| 4                  | .56                | -1.82    | 24                | .15   | 18          | 7                     | 13.97 | 13.25                | -.72     | 95  | 27.10                  | Hartley Wintney        |
| 5                  | .55                | -2.00    | 22                | .48   | 27          | 6                     | 12.81 | 13.01                | + .20    | 102 | 24.66                  | Hitchin                |
| 6                  | .48                | -2.29    | 17                | .17   | 28          | 6                     | 14.05 | 13.48                | -.57     | 96  | 26.75                  | Addington              |
| 7                  | .45                | -2.46    | 15                | .10   | 18          | 10                    | 13.23 | 14.30                | +1.07    | 108 | 25.39                  | Westley                |
| 8                  | .53                | -2.17    | 20                | .10   | 23          | 11                    | 12.82 | 16.31                | +3.49    | 127 | 25.40                  | Brundall               |
| 9                  | 1.37               | -1.41    | 49                | .59   | 28          | 9                     | 19.14 | 22.55                | +3.41    | 118 | 39.00                  | Winterbourne St. Peter |
| 10                 | .78                | -1.95    | 29                | .29   | 28          | 8                     | 17.78 | 16.14                | -1.64    | 91  | 35.00                  | Torquay                |
| 11                 | 1.54               | -1.39    | 53                | .53   | 26          | 17                    | 18.38 | 21.61                | +3.23    | 118 | 38.85                  | Polapit Tamar          |
| 12                 | 1.03               | -1.80    | 36                | .49   | 28          | 8                     | 15.86 | 14.76                | -1.10    | 93  | 30.75                  | Bath                   |
| 13                 | 1.16               | -1.74    | 40                | .38   | 28          | 9                     | 15.73 | 14.64                | -1.09    | 93  | 29.85                  | Stroud                 |
| 14                 | .61                | -2.05    | 23                | .11   | 13          | 11                    | 16.97 | 14.31                | -2.66    | 84  | 33.04                  | Woolstaston            |
| 15                 | .80                | -1.58    | 34                | .29   | 14          | 8                     | 12.95 | 12.91                | -.04     | 100 | 24.50                  | Bromsgrove             |
| 16                 | .36                | -2.08    | 15                | .16   | 10          | 7                     | 12.20 | 11.17                | -1.03    | 92  | 23.30                  | Boston                 |
| 17                 | .44                | -2.07    | 17                | .21   | 28          | 5                     | 13.32 | 10.74                | -2.58    | 81  | 24.70                  | Hodsock Priory         |
| 18                 | .55                | -2.08    | 21                | .14   | 11          | 10                    | 14.11 | 12.20                | -1.91    | 86  | 26.18                  | Derby                  |
| 19                 | 1.90               | -2.22    | 46                | .39   | 16          | 17                    | 20.87 | 24.67                | +3.80    | 118 | 42.43                  | Bolton                 |
| 20                 | 1.57               | -1.04    | 60                | .65   | 30          | 11                    | 14.24 | 13.51                | -.73     | 95  | 26.96                  | Ribston Hall           |
| 21                 | 2.91               | -2.06    | 59                | .56   | 30          | 17                    | 31.44 | 37.06                | +5.62    | 118 | 60.96                  | Arncliffe Vic.         |
| 22                 | 1.75               | -.75     | 70                | .52   | 11          | 12                    | 13.74 | 12.06                | -1.68    | 88  | 27.02                  | Hull                   |
| 23                 | 1.46               | -1.45    | 50                | .37   | 31          | 13                    | 14.26 | 14.38                | + .12    | 101 | 27.99                  | Newcastle              |
| 24                 | 8.42               | -.95     | 90                | 1.71  | 13          | 17                    | 66.73 | 71.87                | +5.14    | 108 | 132.68                 | Seathwaite             |
| 25                 | .97                | -2.55    | 28                | .34   | 13          | 16                    | 20.71 | 24.55                | +3.84    | 119 | 42.81                  | Cardiff                |
| 26                 | 1.68               | -2.02    | 45                | .32   | 30          | 16                    | 23.37 | 24.51                | +1.14    | 105 | 47.88                  | Haverfordwest          |
| 27                 | 2.51               | -1.76    | 59                | .38   | 13          | 17                    | 21.86 | 26.55                | +4.69    | 121 | 45.41                  | Gogerddan              |
| 28                 | .82                | -1.79    | 31                | .21   | 13          | 11                    | 14.79 | 16.54                | +1.75    | 112 | 30.98                  | Llandudno              |
| 29                 | 2.45               | -.85     | 74                | .66   | 22          | 11                    | 22.05 | 22.43                | + .38    | 102 | 43.43                  | Cargen                 |
| 30                 | 2.38               | -.88     | 73                | .71   | 22          | 17                    | 17.14 | 16.83                | -.31     | 98  | 33.04                  | Riddell House          |
| 31                 | 1.79               | ...      | ...               | .54   | 2           | 16                    | ...   | 14.72                | ...      | ... | ...                    | Edinburgh              |
| 32                 | 2.63               | -.67     | 80                | .80   | 14          | 17                    | 22.13 | 21.38                | -.75     | 97  | 44.85                  | Colmonell              |
| 33                 | 2.35               | -1.01    | 70                | .46   | 18          | 21                    | 18.30 | 20.25                | +1.95    | 111 | 35.80                  | Glasgow                |
| 34                 | 4.30               | -.03     | 99                | .76   | 14          | 19                    | 28.98 | 35.73                | +6.75    | 123 | 57.90                  | Tighnabruaich          |
| 35                 | 4.49               | + .11    | 103               | 1.08  | 17          | 22                    | 28.22 | 27.28                | -.94     | 97  | 57.53                  | Quinish                |
| 36                 | .90                | -2.12    | 30                | .60   | 31          | 8                     | 15.12 | 11.75                | -3.36    | 78  | 28.95                  | Dundee                 |
| 37                 | 1.20               | -1.69    | 41                | ...   | ...         | ...                   | 17.83 | 18.61                | + .78    | 104 | 36.07                  | Braemar                |
| 38                 | 2.54               | -.48     | 84                | 1.31  | 31          | 14                    | 16.71 | 16.49                | -.22     | 99  | 33.01                  | Aberdeen               |
| 39                 | 2.01               | -1.33    | 60                | .54   | 17          | 15                    | 15.26 | 16.14                | + .88    | 106 | 29.37                  | Cawdor                 |
| 40                 | 3.95               | + .17    | 104               | 1.35  | 17          | 7                     | 28.50 | 30.40                | +1.90    | 107 | 56.00                  | Invergarry             |
| 41                 | 9.24               | +2.78    | 143               | 2.45  | 18          | 27                    | 42.50 | 54.72                | +12.22   | 129 | 86.50                  | Bendamp                |
| 42                 | 3.34               | + .52    | 118               | 1.13  | 17          | 11                    | 16.27 | 21.64                | +5.37    | 133 | 31.60                  | Dunrobin Castle        |
| 43                 | 2.28               | ...      | ...               | .43   | 19          | 18                    | ...   | 20.47                | ...      | ... | ...                    | Castletown             |
| 44                 | 3.97               | -.02     | 99                | .79   | 1           | 26                    | 29.98 | 26.76                | -3.22    | 89  | 58.11                  | Killarney              |
| 45                 | 1.81               | -1.29    | 58                | .37   | 31          | 13                    | 20.29 | 18.67                | -1.62    | 92  | 39.30                  | Waterford              |
| 46                 | 3.43               | + .49    | 117               | .60   | 26          | 23                    | 17.06 | 21.39                | +4.33    | 125 | 33.47                  | Hurdlestown            |
| 47                 | 1.59               | -1.43    | 53                | .26   | 12          | 15                    | 18.05 | 16.32                | -1.73    | 90  | 34.44                  | Carlow                 |
| 48                 | 1.02               | -1.61    | 39                | .28   | 1           | 13                    | 14.51 | 13.66                | -.85     | 94  | 27.75                  | Dublin                 |
| 49                 | 3.64               | + .33    | 110               | .67   | 31          | 24                    | 19.23 | 22.29                | +3.06    | 116 | 37.04                  | Ballinasloe            |
| 50                 | 6.22               | + .07    | 101               | 1.05  | 27          | 19                    | 40.44 | 41.00                | + .56    | 101 | 80.23                  | Kylemore House         |
| 51                 | 3.75               | + .16    | 104               | .69   | 27          | 24                    | 25.33 | 29.44                | +4.11    | 116 | 50.50                  | Ennisceoe              |
| 52                 | 4.50               | -.90     | 74                | .50   | 22          | 18                    | 20.32 | 17.93                | -2.39    | 88  | 38.61                  | Seaforde               |
| 53                 | 2.02               | -1.45    | 58                | .39   | 12          | 22                    | 20.54 | 23.04                | +2.50    | 112 | 41.20                  | Londonderry            |
| 54                 | 2.75               | -.64     | 81                | .40   | 12          | 22                    | 19.25 | 23.24                | +3.99    | 121 | 37.85                  | Omagh                  |
| 55                 | 3.81               | +1.92    | 202               | 2.69  | 28          | 12                    | 10.26 | 12.46                | +2.20    | 121 | 24.66                  | Hitchin                |

## SUPPLEMENTARY RAINFALL, JULY, 1906.

| Div.  | STATION.                          | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | ·74             | XI.    | Rhayader, Tyrmynydd .....         | 1·44            |
|       | Ramsgate, West Cliff Villas ..... | ·39             |        | Lake Vyrnwy .....                 | 1·25            |
|       | Hailsham .....                    | ·52             |        | Llangyhanall, Plas Draw .....     | ·84             |
|       | Crowborough, Uckfield Lodge ..... | ·90             |        | Criccieth, Talarvor .....         | 1·10            |
|       | Osborne, Newbarn Cottage .....    | ·74             |        | Llanberis, Pen-y-pass .....       | 4·45            |
|       | Emsworth, Redlands .....          | ·45             |        | Lligwy .....                      | 1·20            |
|       | Alton, Ashdell .....              | ·46             |        | Douglas, Woodville .....          | 2·39            |
|       | Newbury, Welford Park .....       | ·68             | XII.   | Stoneykirk, Ardwell House .....   | 3·11            |
| III.  | Harrow Weald, Hill House .....    | 1·17            |        | Dalry, The Old Garroch .....      | 3·70            |
|       | Oxford, Magdalen College .....    | 1·00            |        | Langholm, Drove Road .....        | 3·06            |
|       | Bloxham Grove .....               | ·86             |        | Moniaive, Maxwellton House .....  | 2·93            |
|       | Pitaford, Sedgebrook .....        | ·77             | XIII.  | N. Esk Reservoir [Penicuik] ..... | 2·90            |
|       | Huntingdon, Brampton .....        | ·63             | XIV.   | Maybole, Knockdon Farm .....      | 2·47            |
|       | Wisbech, Bank House .....         | ·31             | XV.    | Campbeltown, Witchburn .....      | 2·95            |
| IV.   | Southend Water Works .....        | ·77             |        | Inveraray, Newtown .....          | 4·91            |
|       | Colchester, Lexden .....          | ·25             |        | Ballachulish House .....          | 6·70            |
|       | Newport, The Vicarage .....       | ·75             |        | Islay, Eallabus .....             | 3·31            |
|       | Rendlesham .....                  | ·15             | XVI.   | Dollar Academy .....              | 2·47            |
|       | Swaffham .....                    | ·67             |        | Loch Leven Sluice .....           | 1·29            |
|       | Blakeney .....                    | ·54             |        | Balquhiddy, Stronvar .....        | 4·50            |
| V.    | Bishops Canning .....             | 1·06            |        | Perth, Pitcullen House .....      | 1·24            |
|       | Ashburton, Druid House .....      | ·78             |        | Coupar Angus Station .....        | ·92             |
|       | Okehampton, Oaklands .....        | 1·27            |        | Blair Atholl .....                | 2·65            |
|       | Hartland Abbey .....              | 1·55            |        | Montrose, Sunnyside Asylum .....  | 1·76            |
|       | Lynmouth, Rook House .....        | ·72             | XVII.  | Alford, Lynturk Manse .....       | 1·99            |
|       | Probus, Lamellyn .....            | 1·72            |        | Keith Station .....               | 2·70            |
|       | Wellington, The Avenue .....      | ·55             | XVIII. | N. Uist, Lochmaddy .....          | 3·88            |
|       | North Cadbury Rectory .....       | 1·40            |        | Alvey Manse .....                 | 1·93            |
| VI.   | Clifton, Pembroke Road .....      | 1·85            |        | Loch Ness, Drumnadrochit .....    | 2·02            |
|       | Moreton-in-Marsh, Longboro' ..... | 1·12            |        | Glencarron Lodge .....            | 8·51            |
|       | Ross, The Graig .....             | ·50             |        | Fearn, Lower Pitkerrie .....      | 1·93            |
|       | Shifnal, Hutton Grange .....      | 1·08            | XIX.   | Invershin .....                   | 3·44            |
|       | Cheadle, The Heath House .....    | ·85             |        | Altnaharra .....                  | 3·27            |
|       | Coventry, Kingswood .....         | ·97             |        | Bettyhill .....                   | 3·87            |
| VII.  | Market Overton .....              | 1·14            |        | Watten Station .....              | 2·16            |
|       | Market Rasen .....                | 1·16            | XX.    | Dunmanway, The Rectory .....      | 4·15            |
|       | Bawtry, Hesley Hall .....         | ·58             |        | Cork .....                        | 3·27            |
| VIII. | Neston, Hinderton .....           | 1·11            |        | Darrynane Abbey .....             | 4·30            |
|       | Southport, Hesket Park .....      | 1·18            |        | Glenam [Clonmel] .....            | 2·47            |
|       | Chatburn, Middlewood .....        | 2·08            |        | Ballingarry, Gurteen .....        | 3·30            |
|       | Cartmel, Flookburgh .....         | 2·98            |        | Miltown Malbay .....              | 3·28            |
| IX.   | Langsett Moor, Up. Midhope .....  | 3·30            | XXI.   | Gorey, Courtown House .....       | 1·07            |
|       | Scarborough, Scalby .....         | 1·08            |        | Moynalty, Westland .....          | 2·76            |
|       | Ingleby Greenhow .....            | 1·66            |        | Athlone, Twyford .....            | 3·56            |
|       | Mickleton .....                   | 1·51            |        | Mullingar, Belvedere .....        | 2·34            |
| X.    | Bardon Mill, Beltingham .....     | 1·87            | XXII.  | Woodlawn .....                    | 3·75            |
|       | Ewesley, Fallowlees .....         | 2·28            |        | Westport, Murriak Abbey .....     | 2·60            |
|       | Ilderton, Lilburn Cottage .....   | 1·54            |        | Collooney, Markree Obay .....     | 2·22            |
|       | Keewick, York Bank .....          | 2·82            | XXIII. | Enniskillen, Portora .....        | 2·42            |
| XI.   | Llanfrecfa Grange .....           | ·73             |        | Warrenpoint, Summer Hill .....    | 2·41            |
|       | Treherbert, Tyn-y-waun .....      | 2·38            |        | Banbridge, Milltown .....         | 1·91            |
|       | Carmarthen, The Friary .....      | 1·68            |        | Belfast, Springfield .....        | 2·25            |
|       | Castle Malgwyn [Llechryd] .....   | ·95             |        | Bushmills, Dundarave .....        | 1·75            |
|       | Plynlimon .....                   | 4·75            |        | Stewartstown, The Square .....    | 2·96            |
|       | Tall-y-llyn .....                 | 2·00?           |        | Killybegs .....                   | 4·76            |
|       | New Radnor, Ednol .....           | ·87             |        | Horn Head .....                   | 2·77            |

## METEOROLOGICAL NOTES ON JULY, 1906.

**ABBREVIATIONS.**—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

**LONDON, CAMDEN SQUARE.**—Splendid weather prevailed throughout, with high temp., a large amount of sunshine and pronounced absence of R. TS on the morning of 27th. Mean temp.  $64^{\circ}\cdot9$ , or  $1^{\circ}\cdot6$  above the average. Duration of sunshine  $235\cdot9^*$  hours and of R  $8\cdot6$  hours.

**CROWBOROUGH.**—Brilliant weather with no extreme or oppressive heat. Several moderate TSS. R  $1\cdot89$  in. below the average of 35 years. Mean temp.  $61^{\circ}\cdot5$ .

**BURY ST. EDMUNDS.**—Dry and hot, with the least R, except in 1868, for 50 years.

**WINTERBOURNE STEEPLETON.**—A cold July, especially at night, grass frost being registered on 1st. R about an inch below the average.

**TORQUAY.**—Duration of sunshine  $272\cdot8^*$  hours, or  $49\cdot8$  hours above the average. Mean temp.  $62^{\circ}\cdot1$ , or  $0^{\circ}\cdot3$  above the average. Mean amount of ozone  $4\cdot4$ .

**NORTH CADBURY RECTORY.**—Pleasant and summerlike, with low R but temp. below the average. The air was frequently very humid and a large hay crop was got in with difficulty.

**CLIFTON.**—Fine on the whole, with moderate temp. and weather mostly of the "westerly type" with slight R every few days, the total being  $1\cdot65$  in. below the average.

**ROSS.**—Remarkably dry, with no TSS and average temp. Only 4 previous Julys had lower R since 1818.

**BOLTON.**—Very bright and dry. Owing to excessive humidity and absence of wind, the heat was on many days oppressive, though the mean temp.,  $56^{\circ}\cdot6$ , was  $1^{\circ}\cdot0$  below the average. Duration of sunshine  $150\cdot7^*$  hours, or  $0\cdot5$  hours above the average.

**SOUTHPORT.**—The tenth consecutive abnormally dry July. Mean temp.  $59^{\circ}\cdot2$ , or  $0^{\circ}\cdot5$  below the average. Duration of sunshine  $224\cdot4^*$  hours, or  $12\cdot0$  hours above the average. R  $1\cdot81$  in. below the average; duration  $25\cdot3$  hours.

**LILBURN.**—Very dry, with warm days and cool nights. Severe TS on 31st, and severe damage by L in many places, but not here.

**HAVERFORDWEST.**—Fine and warm, with small R. Hay crops were good and well saved and crops generally were looking well. Duration of sunshine  $148\cdot0^*$  hours.

**DOUGLAS.**—Fine on the whole, with much bright sunshine and many beautiful days. The record was, however, sadly marred by wet, windy and even wintry weather from 12th to 20th.

**INVERARAY.**—Variable, with only two or three days of real summer weather. The earlier part was cold and the latter wet.

**ABERDEEN.**—TS on 31st with  $1\cdot31$  in. of R from 11 a.m. to 7 p.m.

**WATTEN.**—The first part was dry and cloudy. A severe and prolonged storm of wind and R occurred on 19th and 20th.

**CASTLETOWN.**—About midnight on 18th a strong westerly gale set in, attaining the force of 8–9 during the forenoon of 19th and lasting till noon on 21st. The last few days were dry, warm and foggy, except 31st, which was wet.

**DARRYNANE ABBEY.**—R  $14\cdot8$  per cent. above the average, only 3 days being without R. Fog on 21st and 22nd.

**MILTOWN MALBAY.**—Generally damp, with lowering skies and little sunshine. As usual, this weather left potato blight, which is now general.

**DUBLIN.**—A favourable month, with westerly winds, often cloudy skies, an frequent but not heavy R. Mean temp.  $60^{\circ}\cdot7$ .

**OMAGH.**—As a rule the weather was dark and cloudy, but as the R was below the average for the first fortnight a heavy crop of hay was saved in excellent order in all but backward districts.

\* Campbell-Stokes.

## Climatological Table for the British Empire, February, 1906.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |       |               |           | Absolute.       |                   | Total Rain. |       | Aver.  |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|-------|---------------|-----------|-----------------|-------------------|-------------|-------|--------|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min.  | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.      | Days. | Cloud. |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |       |               |           |                 |                   |             |       |        |
|                                                                  | °         |       | °        |       | °        | °     | °             | 0-100     | °               | °                 | inches      |       |        |
| London, Camden Square                                            | 51·1      | 24    | 26·1     | 22    | 45·0     | 33·3  | 34·7          | 87        | 85·1            | 20·3              | 1·89        | 21    | 6·1    |
| Malta.....                                                       | 67·9      | 28    | 40·2     | 14    | 57·9     | 47·3  | 43·9          | 76        | 115·5           | 34·3              | 6·45        | 18    | 5·3    |
| Lagos.....                                                       | 91·0      | 6, 9  | 72·0     | 2     | 88·1     | 76·3  | 73·1          | 76        | 140·0           | 63·5              | 2·18        | 8     | 4·5    |
| Cape Town .....                                                  | 101·5     | 20    | 54·0     | 2     | 79·5     | 62·1  | 56·9          | 62        | ...             | ...               | ·05         | 2     | 2·2    |
| Durban, Natal .....                                              | 92·0      | 13    | 60·1     | 18    | 84·1     | 67·6  | ...           | ...       | 154·4           | ...               | 6·31        | 15    | 4·9    |
| Johannesburg .....                                               | 79·8      | 26    | 47·6     | 19    | 73·3     | 54·8  | 56·1          | 84        | 155·6           | 43·2              | 8·54        | 13    | 4·9    |
| Mauritius.....(?)                                                | 90·1      | 8     | 71·4     | 24    | 87·2     | 74·0  | 73·6          | 81        | 160·4           | 65·3              | 5·04        | 23    | 7·2    |
| Calcutta.....                                                    | 87·4      | 9     | 53·1     | 1     | 79·0     | 62·7  | 63·5          | 76        | 154·0           | 48·5              | 7·06        | 8     | 5·1    |
| Bombay.....                                                      | 90·0      | 28    | 62·0     | 25    | 81·3     | 66·9  | 61·9          | 68        | 142·0           | 53·6              | ·15         | 2     | 1·5    |
| Madras .....                                                     | 94·8      | 19a   | 64·4     | 3     | 87·9     | 72·6  | 71·0          | 77        | 146·3           | 60·3              | ·94         | 3     | 3·2    |
| Kodaikanal .....                                                 | 73·1      | 23    | 47·2     | 3     | 67·3     | 50·7  | 47·3          | 68        | 141·8           | 29·7              | 3·37        | 4     | 4·0    |
| Colombo, Ceylon.....                                             | 90·0      | 21    | 70·6     | 5     | 88·2     | 75·7  | 72·1          | 76        | 151·0           | 68·0              | ·85         | 4     | 2·5    |
| Hongkong.....                                                    | 79·1      | 22    | 47·0     | 2     | 64·0     | 56·6  | 57·2          | 87        | 131·2           | ...               | 2·25        | 15    | 9·1    |
| Melbourne.....                                                   | 105·1     | 21    | 48·3     | 25    | 81·4     | 58·4  | 55·2          | 62        | 159·1           | 37·2              | ·44         | 7     | 4·7    |
| Adelaide .....                                                   | 108·6     | 7     | 53·5     | 10    | 92·0     | 66·4  | 55·3          | 45        | 160·4           | 45·0              | ·12         | 3     | 3·3    |
| Coolgardie .....                                                 | 105·0     | 19    | 58·1     | 9     | 93·6     | 66·2  | 61·5          | 53        | 175·9           | 56·9              | ·80         | 8     | 3·2    |
| Sydney .....                                                     | 97·3      | 22    | 60·2     | 14    | 78·2     | 66·6  | 61·2          | 69        | 134·8           | 53·2              | ·38         | 14    | 6·0    |
| Wellington .....                                                 | 70·0      | 2     | 41·8     | 20    | 63·3     | 52·8  | 51·3          | 80        | 130·0           | 38·0              | 7·48        | 16    | 7·0    |
| Auckland .....                                                   | 76·0      | 2     | 50·0     | 21    | 69·8     | 56·2  | 52·3          | 69        | 140·0           | 45·0              | 2·25        | 8     | 5·0    |
| Jamaica, Negril Point.....                                       | 87·9      | 11    | 64·9     | var.  | 83·4     | 68·5  | 68·7          | 80        | ...             | ...               | 2·03        | 5     | ...    |
| Trinidad .....                                                   | 90·0      | 24    | 63·0     | 23a   | 85·5     | 66·6  | 69·0          | 77        | 169·0           | 58·0              | ·50         | 4     | ...    |
| Grenada.....                                                     | 85·8      | 28    | 69·0     | 16    | 83·1     | 71·4  | 68·2          | 73        | 130·8           | ...               | 1·92        | 18    | 3·0    |
| Toronto .....                                                    | 53·0      | 24    | -12·8    | 2     | 31·0     | 13·6  | 16·2          | 79        | 71·0            | -16·0             | ·80         | 12    | 5·8    |
| Fredericton .....                                                | 53·3      | 22    | -14·3    | 17    | 34·4     | 7·8   | 8·3           | 60        | ...             | ...               | 2·04        | 7     | 5·7    |
| Winnipeg .....                                                   | 38·4      | 19    | -32·5    | 13    | 14·2     | -10·5 | ...           | ...       | ...             | ...               | ·21         | ...   | 3·5    |
| Victoria, B.C. ....                                              | 55·2      | 17    | 31·0     | 12    | 49·4     | 33·5  | ...           | ...       | ...             | ...               | 1·66        | 14    | 6·4    |
| Dawson .....                                                     | 15·0      | 27    | -39·0    | 22    | -2·6     | -13·9 | ...           | ...       | ...             | ...               | ·51         | 6     | 5·0    |

a and 23. b and 24, 25, 26.

MALTA.—Mean temp. of air 52°·2, or 1°·8 below average. Mean hourly velocity of wind 13·6 miles. Mean temp. of sea 56°·7.

Johannesburg.—2·42 in. of R fell in 43 minutes, tearing holes 6 feet deep in roads.

Mauritius.—Mean temp. of air 1°·4, of dew point 2°·7 above and R 2·20 in. below, averages. Mean hourly velocity of wind 6·8 miles, or 4·2 below average.

MADRAS.—Bright sunshine 226 hours.

KODAIKANAL.—Bright sunshine 202 hours.

COLOMBO.—Mean temp. of air 82°·0, or 1°·8 above, of dew point 1°·6 above, and R 1·22 in. below, averages. Mean hourly velocity of wind 6·7 miles.

HONGKONG.—Mean temp. of air 60°·4, or 2°·6 above, bright sunshine 41·3 hours, or 45·4 below average. Mean hourly velocity of wind 17·0 miles.

Adelaide.—Mean temp. of air 5°·3 above, and R 49 in. below, averages.

Coolgardie.—Mean temp. of air 4°·9 above average.

Sydney.—R 4·34 in. below, and mean temp. of air 1°·3 above, averages.

Wellington.—Mean temp. of air 4°·4 below, and R 4·24 in. above, averages.

# Symons's Meteorological Magazine.

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## LOCAL SOCIETIES AND METEOROLOGY.

*(Continued from p. 125.)*

The value of a record of climate grows with its length, and the interruption of private records by death or removal is a difficulty most grievous to the investigator who desires to study the climate of any locality.

A complete meteorological observatory, with self-recording apparatus of the highest accuracy, forming what is technically termed "a first order station," is a costly matter, and involves a paid staff; but a second order station, at which the instruments are read by the eye only, twice a day, is well within the powers of even a small Society. Full particulars of the equipment of such a station may be found in the admirable practical handbook "*Hints to Meteorological Observers*," by Mr. W. Marriott, of the Royal Meteorological Society, and any request for advice in the establishment of a station addressed to the Secretaries of that Society, at 70, Victoria Street, London, S.W., will receive a sympathetic reply. In Scotland similar enquiries might be addressed to the Scottish Meteorological Society, 122, George Street, Edinburgh.

The Royal Meteorological Society is doing a great deal to disseminate correct views of weather-study, and has arranged a scheme of lectures and exhibitions of apparatus and maps in connection with local societies that ought to be taken advantage of largely. It would be well for any Society taking up such work to arrange for two or three observers who could be trusted to relieve each other, so that the work could be carried on continuously, without imposing too heavy a burden on any one person; but it would be well also for one individual to be responsible for the record, both for preserving the original in safety and for making an authentic copy for transmission to some central authority.

There is an amount of uncertainty as to the mean temperature and the other conditions of climate, even in the thickly-peopled parts of England, which is hard to believe until one tries to ascertain definite figures on the subject. It is not creditable that such a state of matters exists, and it is very easy to obviate it at small expense, though for many years the chief value of the work must



lie in the future. Meteorological data differ greatly in their nature, and some require more observers than others. To two of these I wish to direct special attention, one is the least known, the other the best known, of the elements of climate.

The first is the duration of sunshine. No full or trustworthy map of the average annual duration of sunshine exists, although from the points of view of agriculture and of health, sunshine is of very great importance. Unfortunately there are photographic sunshine recorders on the market which give results that cannot be properly compared, and their use has led to considerable confusion. The instrument which is accepted as a standard by the Meteorological Office and by the Royal Meteorological Society, is the Campbell-Stokes sunshine recorder, which consists in principle of a clear glass sphere focussing the sun's image on a prepared card, in which it burns a hole when the sun is shining. By this instrument only bright sunshine is measured, but the records of different instruments of this type are strictly comparable, and it is most important that the number in use should be greatly increased. I would urge any Society desirous of undertaking an interesting and useful set of observations, but unwilling to establish a complete meteorological station, to set up a sunshine recorder, and after measuring the cards send them to the Meteorological Office, or to one of the Meteorological Societies, for preservation and discussion.

The second matter is on a different footing. It is the measurement of rainfall. A few hundred stations would suffice to give a perfectly fair view of the distribution of pressure or temperature over the whole of the British Isles, because these phenomena affect the air nearly uniformly over wide areas, and are almost independent of local accidents of configuration of the ground. The changes due to altitude above sea-level are simple and can be calculated for any place when the altitude is known. With rainfall it is entirely different. While widespread rains sometimes occur uniformly affecting large areas, there are often sudden heavy showers so local that places a mile apart may have in an afternoon rain differing in amount by an inch or more. It is also known that every variation of form in the land exercises its individual influence on the rain-bearing winds so that every locality has its own characteristic average rainfall with a large range from year to year and a varying chance of sudden heavy falls. For this reason it is necessary in order to represent the conditions of rainfall in the country to have a very large number of stations, and there are, in fact, more than 4,000 observers in the British Isles whose results are regularly published and discussed in *British Rainfall*. If these 4,000 gauges were uniformly spaced out like trees in a new plantation, and if they were all secured against the risk of interruption, no more would be required; but as neither of these conditions hold good, there is an urgent need for new observers in many places, and room for them everywhere. In order not to miss the interesting features of the

more widespread heavy falls of rain there should be a station at every 5 miles, and in order to secure continuity in one locality there should at each five-mile centre be two, if not three stations within half-a-mile of each other, so that when one record comes to an end there may be another close by the relation of which to that ceasing has been established. This is a counsel of perfection, and I do not expect to see it realized ; but it is not too much to hope that five-mile circles from every rain gauge in England and Wales shall intersect, and that ten-mile circles in Scotland and Ireland may at least touch. How far that is from being the case at present can be seen from the map exhibited,\* which shows some great gaps the existence of which makes the preparation of annual rainfall maps a matter of doubt and difficulty.

I know of no way so open as this for any Society to advance science and interest its members in a piece of valuable scientific work. While I think it is desirable, in order to ensure uniformity of methods and direct communication as to doubtful points in the records, that every rainfall observer in the country should be in personal communication with the British Rainfall Organization, I feel also that an immense amount of encouragement is given and a valuable check afforded by subsidiary local organizations such as are carried on by numerous scientific societies in many parts of the country. The Meteorological Office supports and inspects a small number of selected stations spread over all parts of the British Isles, the Royal Meteorological Society in England and Wales and the Scottish Meteorological Society in the northern kingdom arrange for and inspect a larger number, and I am not sure whether the following list of local societies which do similar work systematically is complete ; I hope it may be extended, but at any rate it is extremely creditable to the societies concerned and deserves to be followed as an example. For the sake of impartial enumeration they are given alphabetically :—

*Croydon Natural History and Scientific Society* (Mr. F. Campbell Bayard).—102 stations in north-western Kent and eastern Surrey.

*Dorset Field Club* (Mr. H. Stilwell).—48 stations in Dorset.

*Hertfordshire Natural History Society* (Mr. J. Hopkinson).—55 stations in Herts.

*Northamptonshire Natural History Society* (Mr. C. A. Markham).—41 stations in Northamptonshire.

*North Devon Athenæum* (Mr. Wainwright, Barnstaple).—30 stations in North Devon and Somerset.

In addition to these Societies there are several county or group organizations which I believe are kept up by individuals without the guarantee of continuity that a Society affords ; these are :—

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\* Published in *British Rainfall*, 1905.

*Cambridge and Huntingdon.*—59 stations formerly under the care of Mr. Warren, now being continued by the Editor of *British Rainfall*.

*Isle of Man.*—9 stations in the care of Mr. A. W. Moore.

*The English Lake District.*—27 stations the data from which are collected by Miss Marshall, in succession to her father, the late Mr. Stephen Marshall.

*Norfolk.*—35 stations under the care of Mr. A. W. Preston.

*Mid-Wessex.*—32 stations in portions of Wilts, Dorset and Somerset, in the care of Rev. H. A. Boys.

*Stirlingshire.*—22 stations in the care of Mr. C. Stirling.

In addition to these there is the Cornwall County Council with 27 stations, and the Great Central Railway and most of the Canal and Water Companies and Water Authorities in the country which maintain rain gauges on their gathering grounds are enlightened enough to make their records available for scientific purposes.

I am happy at all times to supply full instructions for commencing and carrying on records of rainfall and to endeavour to remove any difficulties which may arise in the course of such work.

#### REPORT OF KITE COMMITTEE OF BRITISH ASSOCIATION.

*Investigation of the Upper Atmosphere by means of Kites in co-operation with a Committee of the Royal Meteorological Society.*—*Fifth Report of the Committee, consisting of* Dr. W. N. SHAW (*Chairman*), Mr. W. H. DINES (*Secretary*), Mr. D. ARCHIBALD, Mr. C. VERNON BOYS, Dr. A. FUCHAN, Dr. R. T. GLAZEBROOK, Dr. H. R. MILL, Professor A. SCHUSTER, and Dr. W. WATSON. (*Drawn up by the Secretary.*)

SINCE the date of sending in the last report an investigation into the conditions prevailing over the North Sea has been carried on by Mr. G. C. Simpson, who kindly undertook the work at the request of the Joint Committee. Mr. Simpson spent three weeks on the North Sea in the mission ship *Alexandra*, which was attached to the Red Cross Trawling Fleet. The results he obtained have been published in the *Quarterly Journal of the R. Met. Soc.*, Vol. XXXII., No. 137.

Observations were also continued at Oxshott, on behalf of the Joint Committee, down to the end of September, 1905, and the results of these observations, together with those previously obtained at Crinan and at Oxshott, have been published in the *Proceedings of the Royal Society*, A, Vol. LXXVII., 1906.

Since October 1, 1905, the work of obtaining systematic observations has been undertaken by the Meteorological Office, whose station is at present situated at Oxshott; but Mr. Simpson is arranging a kite station on the moors near Manchester, at which it is hoped that kite ascents can be made on suitable days, and more particularly on the days appointed by the International Committee.

The Committee ask for re-appointment, and for a grant of £25.

## BRITISH RAINFALL, 1905.\*

THE new volume of *British Rainfall* records the total annual rainfall at 4096 stations in Great Britain and Ireland, the number of records having increased from last year approximately at the rate of  $1\frac{1}{2}$  per cent. in Ireland, 2 per cent. in Wales, 3 per cent. in England, and 4 per cent. in Scotland. In the usual article on the Staff of Observers a map is given showing the density of distribution of rain gauges over the British Isles, on which all parts of the country more than five miles from the nearest existing gauge are shown in white, and a line encircles those parts of this area which are more than ten miles from a gauge. The largest of these totally unrepresented areas lie in the west, south and north of Ireland; in the central Highlands of Scotland south of the Caledonian Canal, and in Rossshire, Sutherland and Caithness: these are the parts of the country where the establishment of new records is most to be desired.

The usual discussion and maps of monthly and annual rainfall appear, and the occurrence of heavy rain on rainfall days is dealt with in the same detail as in recent years. The number of heavy widespread rains was considerably less than usual; but maps are given of five interesting cases, the most remarkable being that which brought the floods of August 25th in Ireland. In all the cases mapped the area in which a great precipitation occurred lay on the left of the path of a cyclonic disturbance.

The distribution of rainfall in time is dealt with as to (1) number of Rain Days and the number of days with various amounts of rain classified in eight groups, (2) Droughts and (3) Rain Spells; 73 carefully selected records, as uniformly distributed over the country as possible and believed to be perfect in all respects, being analyzed for each of the three discussions.

There are records of duration of rainfall at eight stations, being one more than in 1904, and records of evaporation at eleven stations, and regret is expressed that more determinations of these very important conditions are not made, or if made are not communicated to the Editor.

The special articles in this volume deal with "German Rainfall," a 14-page synopsis of Professor Hellmann's great work briefly noticed on pp. 110-111 of our July number; and with a comparison of the evaporation from a water surface at Camden Square with the other meteorological conditions during 1905. For the purpose of the latter article, the amount of evaporation, amount and duration of rainfall, duration of sunshine, wind-movement 1 foot above the water, mean relative humidity, mean daily temperature of air, 9 a.m. tem-

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\* The full title is: *British Rainfall, 1905. On the Distribution of Rain in space and time over the British Isles during the year 1905, as recorded by more than 4000 Observers in Great Britain and Ireland, and discussed with Articles on various branches of Rainfall Work, by Hugh Robert Mill.* The forty-fifth annual volume. London: Edward Stanford. 1906. Pp. 360.

perature of soil at 1 foot, and daily maximum black bulb temperature are all calculated for 5-day periods and also shown on a diagram in the form of smoothed curves. The result of the comparison was to show that when the rate of evaporation was below the average for the year it followed the mean temperature; when it was above the average for the year it followed the sunshine and the black bulb temperature, and that the wind appeared to have had but little effect on the evaporation.

In the introductory "Report" attention is called to one or two definitions intended to improve the terms employed in the discussion of rainfall. These are as follows: *Mean* is used to express the sum of any number of figures divided by that number, and this use of the word sets free *Average* to be employed to denote the mean of any quantity for a number of years. The word *General* is used to designate the mean of any quantity at a number of stations at the same time, or, in the case of rainfall, the mean depth of the rain over any defined area. Thus the average general rainfall of the British Isles means the average depth of the general rainfall of the country for a definite number of years. The words *Rain Day* (instead of rainy day) are taken to mean a day on which at least .01 in. of rain is recorded; a succession of a certain number of days with no recorded rain is a *Drought*, and a succession of a certain number of rain days is a *Rain Spell*. These terms have been used also in this Magazine for some time and no objection has been taken to them. The most recent, *Rain Spell*, has been approved by Dr. J. A. H. Murray, the eminent lexicographer.

All the familiar features of *British Rainfall* remain as before, but the Editor asks for suggestions as to possible improvement and incidentally indicates the cost of one very obvious improvement—the inclusion of monthly as well as annual values for all stations.

## THE BEAUFORT SCALE OF WIND-FORCE.\*

THERE are two types of instruments employed in the determination of the velocity of motion of the air: (a) the Robinson Cup Anemometer; (b) the Dines Pressure-tube Anemometer. The traces of the Robinson anemometer by recording the total distance travelled in a given time by the centre of the cups revolving under the influence of the wind, show the average velocity of the wind during the given

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\* Abstract of Report of the Director of the Meteorological Office upon an enquiry into the relation between the estimates of Wind-Force according to Admiral Beaufort's scale and the Velocities recorded by Anemometers belonging to the Office, with a report upon certain points in connection with the enquiry, by G. C. Simpson, M.Sc.; and notes by Sir G. H. Darwin, K.C.B., F.R.S., W. H. Dines, F.R.S., and Commander Campbell Hepworth, C.B., R.N.R., Marine Superintendent. Published by authority of the Meteorological Council. Size 12×10. Pp. 54. Plates.

time, but afford no information as to the variation of wind velocity during the time; whereas those of the Dines anemometer, consisting of series of oscillations, indicate variations of wind velocity lasting for less than a minute. From the traces of the Dines instrument the mean velocity of the wind per hour can be nearly, though not exactly, estimated by eye, but the measurements are sufficiently accurate for practical purposes. Mr. Dines from his own experiments indicates the relationship between  $P$ , the pressure of the wind in pounds per square foot, and  $V$ , the recorded velocity in miles per hour by the expression:— $P = .003 V^2$ ; moreover, if  $h$  represents differences of pressure expressed in inches of water, and  $V$  represents velocity in miles per hour (atmospheric pressure at 30 inches of mercury; temperature at 50° F.) he gives:— $h = .00073 V^2$  as the relation according to which his pressure-tube anemometer should be calibrated. From a number of observations made at different places, and discussed by different observers, it is shown that the velocity of the centres of the cups of the Kew pattern Robinson Anemometer should be multiplied by 2.2, in order that a close agreement may be obtained with the wind velocity as recorded by the pressure-tube anemometer. This method for obtaining a constant for the Robinson anemometer depends upon Mr. Dines' empirical graduation of his own type of instrument; and Mr. Dines, presuming that the relation:— $h = .00073 V^2$  is correct, is of opinion that his pressure-tube instrument is correct to 1 per cent.

Comparisons between wind velocities as recorded by anemometers, and wind-forces as estimated by observers according to Beaufort's scale, were made a few years ago by Mr. R. H. Curtis and Professor Köppen, who availed themselves of a large number of data, consisting of the wind estimates according to Beaufort's scale, and the mean wind velocities as recorded by anemometers for the hour in which each of the estimates was made. Curtis separates the pairs of data so obtained into groups, having a common Beaufort number, and takes the mean of the velocities in each group; whilst Köppen separates the pairs into groups in such a way that each group has the same recorded velocity, and then by taking the mean of the Beaufort numbers contained in each group, obtains a number (which may contain a fraction) for each velocity. The relation between the Beaufort numbers and wind velocities may be expressed by a curve having Beaufort numbers for abscissa, and velocities for ordinates, and the two curves as obtained by Curtis' and Köppen's method do not correspond. On account of this divergency in the two curves, the Meteorological Council appointed Mr. G. C. Simpson to prepare a report on the subject; he was commissioned to visit the stations at Aberdeen, North Shields, Holyhead, Yarmouth, Oxford and Scilly, and was supplied with the following data:—(1) Data from Scilly, Yarmouth and Holyhead discussed by Curtis; (2) additional data of the same kind for years 1900-02, for five of the above-named stations; (3) special data from Holyhead and Scilly, consisting of

pressure-tube records. The substance of his report may be here summarized :—

- (1) The relation between Beaufort numbers and wind velocities as used by observers is expressed by Köppen's equivalents.
- (2) When dealing with single observations, Köppen's equivalents must be used.
- (3) When it is required to reduce a number of estimates at any place to mean velocities, Curtis' equivalents give the best results.
- (4) When it is required to express a number of wind velocities recorded at a place by means of Beaufort's scale, Curtis' equivalents also give the best results.
- (5) The mean hourly velocity of the wind, as actually used, is as suitable as any other characteristic of wind velocity, such as the mean velocity in gusts and lulls or the extreme velocity in the hour, for comparing records of wind velocity to estimates of wind-force.
- (6) The estimates of wind-force according to Beaufort's scale are affected by the direction of the wind differently in different places; it is not desirable that any allowance be made for the influence of wind direction upon the estimates. The causes of the difference between Curtis' and Köppen's equivalents are discussed by Mr. Simpson in his report.

#### CURTIS' METHOD.

| Equivalent Velocities. | BEAUFORT NUMBERS. |   |    |    |    |    |    |    |    |     |     |
|------------------------|-------------------|---|----|----|----|----|----|----|----|-----|-----|
|                        | 0                 | 1 | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9   | 10  |
| Scilly .....           | 2                 | 3 | 6  | 9  | 13 | 20 | 26 | 32 | 39 | 46  | 51  |
| Yarmouth .....         | 2                 | 3 | 5  | 9  | 12 | 18 | 24 | 30 | 37 | 42  | ... |
| Holyhead .....         | 2                 | 6 | 11 | 15 | 19 | 21 | 24 | 28 | 34 | 42  | 50  |
| North Shields .....    | 3                 | 5 | 8  | 13 | 19 | 24 | 27 | 29 | 43 | ... | ... |
| Oxford .....           | 2                 | 4 | 7  | 12 | 16 | 19 | 24 | 27 | 29 | ... | ... |
| Mean .....             | 3                 | 5 | 8  | 11 | 15 | 19 | 25 | 29 | 36 | 44  | 51  |

#### KÖPPEN'S METHOD.

|                     |   |   |    |    |    |    |    |    |    |     |     |
|---------------------|---|---|----|----|----|----|----|----|----|-----|-----|
| Scilly .....        | 0 | 2 | 5  | 8  | 13 | 20 | 27 | 35 | 43 | 50  | 57  |
| Yarmouth .....      | 0 | 1 | 4  | 8  | 13 | 20 | 27 | 35 | 43 | 50  | ... |
| Holyhead .....      | 0 | 5 | 10 | 15 | 18 | 22 | 26 | 31 | 40 | 51  | ... |
| North Shields ..... | 0 | 2 | 6  | 15 | 23 | 30 | 34 | 38 | 42 | ... | ... |
| Oxford .....        | 0 | 2 | 7  | 13 | 19 | 24 | 27 | 30 | 35 | ... | ... |
| Mean .....          | 0 | 2 | 6  | 11 | 16 | 22 | 28 | 35 | 42 | 50  | 58  |

The two causes as given by Köppen for the difference between his equivalents and those of Curtis are found by Simpson to account for

only a small fraction of the whole difference. The chief cause of the difference is due to the fact that, it being impossible for observers to estimate the force of the wind with accuracy, the errors of observation are not symmetrical with regard to the true mean velocity corresponding to each Beaufort number. Owing to the different frequencies of different wind strengths, the observer when estimating winds of low force has greater chances of estimating winds as of, say, force 2, which (if he made no errors) he would estimate as of force 3, than he has of estimating winds as of force 2, which (if he made no errors) he would estimate as force 1; hence the mean equivalent velocity for force 2 as deduced by Curtis' method, in which the mean velocities of groups having a *common Beaufort number* are taken, is *higher* than the correct one.

On the other hand, the observer, when estimating winds of higher forces, has more opportunities of estimating winds, say, as of force 6, which he ought to estimate as of force 5, than he has of estimating winds of force 6 which he ought to estimate as of force 7; hence the mean equivalent velocity for force 6 as obtained by Curtis' method is too low. It is then in the nature of observational errors that the discrepancy between the curves of Köppen and Curtis mainly lies.

### Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

#### REMARKABLE DROUGHT IN THE SOUTH OF ENGLAND.

THE total rainfall for the three months, June, July and August, has amounted to only 2·97 in. in this district, made up as follows:—

| JUNE.           |      | JULY.    |     | AUGUST.  |     |
|-----------------|------|----------|-----|----------|-----|
|                 | in.  |          | in. |          | in. |
| 1st ...         | ·12  | 12th ... | ·01 | 2nd ...  | ·04 |
| 16th ...        | ·07  | 13th ... | ·06 | 13th ... | ·14 |
| 23rd ...        | ·38  | 18th ... | ·12 | 14th ... | ·08 |
| 27th ...        | ·06  | 19th ... | ·16 | 15th ... | ·01 |
| 28th ...        | 1·20 | 20th ... | ·01 | 16th ... | ·02 |
|                 |      | 28th ... | ·18 | 17th ... | ·16 |
|                 |      | 29th ... | ·04 | 24th ... | ·11 |
|                 |      |          |     |          |     |
| Totals          | 1·83 |          | ·58 |          | ·56 |
| No. of days ... | 5    |          | 7   |          | 7   |

Thus a period of 92 days included only 19 days on which rainfall was recorded, and it is worthy of note also that had it not been for the heavy isolated fall on June 28th, the totals for the three months would have been ·63 in., ·58 in. and ·56 in. respectively.



Another peculiar feature is that although the general dry character of the weather has been maintained for so long a period, there have been only two absolute droughts (i.e., rainless periods of more than 14 days' duration). The first of these occurred between the 1st and 16th of June, and the second between the 28th June and 12th July.

As I write there seems little prospect of a break in the dry weather.

D. W. HORNER.

*Worthing, September 1st, 1906.*

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### THE THUNDERSTORM OF AUGUST 2nd.

IN the many interesting reports on the thunderstorm of August 2nd the evidence seems general that while there was no stint of lightning, thunder was not remarkably heavy. Such, indeed, was my experience here. I had not seen such a fascinating display of lightning for many years, but there was next to no thunder. Is not this somewhat out of the common way? Some of the electric discharges took place at an altitude of 45° or more. As to rain, my gauge caught .07 in. only, whereas near Holborn Bars there must have been a veritable deluge.

WILLIAM GODDEN.

*West Hampstead, August 29th, 1906.*

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### THE GREEN FLASH.

It is now generally accepted that this is produced by atmospheric refraction, and, as this cause is continually operating, it is remarkable that the phenomenon is so seldom seen. I, therefore, hoped that someone better qualified than I would offer some explanation of the point raised by Mr. Whitmell in his letter at p. 21 of this volume. Can the following considerations be held to solve the difficulty? As the fine particles of matter suspended in the air reflect back the shorter light waves, thus preventing them from reaching the eye of an observer, while they allow the longer waves to flow past them, this would tend to prevent the green flash from being seen, and would act the more effectively in proportion to the number of such particles in the air. That this is really so is rendered the more probable by the facts mentioned by Dr. Rambaut at pp. 23 and 45, viz., that the green flash is not usually found to occur when the sun is strikingly red before setting, and that a haze near the horizon reduces the intensity of the blue-green fringe referred to by him, but does not affect the red fringe. But this cannot be the sole cause, seeing that the particles in question reflect back the short waves entirely away from the Earth; and if this occurred to a sufficient extent to obliterate the green flash completely, it could not be seen either by the help of the belfry, as in Mr. Whitmell's experiment, or of a diaphragm, as in Dr. Rambaut's (p. 44); and yet the

latter was able by means of the diaphragm to exhibit not only the red but also the green flashes as often as he pleased ; nor could the green flash be seen through a telescope if it were quite invisible to the naked eye for the reason above suggested. Hence, even if the intensity of the green flash be diminished in the way above indicated, we must search for some additional grounds which would account for its invisibility to the naked eye and its visibility when looked at through a telescope. Dr. Rambaut's diagram (p. 41) shows that the red and blue fringes would always be seen when the sun is low if it were not for the glare of the sunlight. This operates in at least two ways. One is that some of the white rays are deflected from their course by reflection from particles in the air, and such of these deflected rays as are thrown into the lines along which the light from the fringes passes to the eye would overpower this light and prevent the fringes from being seen. This action would continue, though to a smaller extent than formerly, down to the time that the tip of the sun was disappearing, and so it also would make the green flash less conspicuous. If now we adopt Helmholtz's theory that irradiation is caused by the non-homogeneity of the lenses of the eye, we can understand that it should operate more powerfully when the setting or rising sun is looked at directly with the naked eye than with the interposition of a belfry or telescope. In the former case rays of light from a considerable area round the setting sun might, after passing into the eye, be deflected so as to impinge on that portion of the retina where the image of the green flash was, whereas this area would be very greatly restricted in the case of the experiments above referred to. A little consideration will show that if irradiation be supposed to be a sympathetic effect, it might be more intense if the rays from the space around the green fringe came from a wider area ; so that, on this theory of irradiation also, the non-appearance of the flash to the unassisted eye, though it could be seen through a telescope, might be accounted for.

ALEX. THURBURN.

*Keith.*

[This letter travels to the verge of the meteorological aspect of the green flash, and indeed goes beyond it ; but the question of the infrequency of the phenomenon is an interesting one, on which, perhaps, more can be said.—ED. *S.M.M.*]

### LAMBRECHT'S POLYMER AND HYGROMETER.

IT is a somewhat remarkable circumstance that the hair hygrometer, the remarkable properties of which were pointed out by De Saussure a century and a half ago, should have remained so little known as a scientific instrument. The analogous catgut hygrometer, propelling a man or a woman outside a toy house according as the atmosphere is humid or dry, has always retained its popularity on the continent,

though less frequently seen now than formerly in this country. It is interesting to notice that hair hygrometers have been more generally used for scientific purposes in the form of recording instruments than in a form suited for direct reading by the eye; but we think that the very serviceable direct-reading hair-hygrometer which has been introduced under the name of Lambrecht's Polymeter should do much to make this form of instrument supplement or even supersede the wet and dry bulb hygrometer.

The Polymeter, for which Messrs. Gallenkamp and Co. are the London agents, consists of a thermometer with the value of the saturated vapour pressure at each temperature marked on a duplicate scale, and a hair hygrometer the indicator of which is a needle moving on a circular dial. This dial has two scales, one being the relative humidity expressed directly in percentage of saturation, the other a series of figures giving the difference between the dew-point and the temperature of the air. From these four scales, the readings of two of which are subject to a simple adjustment made by means of the trident-shaped end of the indicating hand, it is possible to measure the temperature, relative humidity, dew-point, absolute humidity and other relations of humidity and temperature—hence the name polymeter. A book of instructions for the adjustment and use of the instrument, the English of which might be improved by revision, gives all the necessary precautions for obtaining useful scientific results. We have tested the instrument and found its indications to correspond closely with the relative humidities calculated by Glaisher's Tables. On one occasion with the thermometer above  $90^{\circ}$  we found a serious discrepancy, but inspection showed that the muslin on the wet bulb thermometer had dried on account of the evaporation being greater than the water-conducting power of the wick, the hair hygrometer having been correct.

The great advantage of the polymeter seems to us to be the facility with which the relative humidity may be read off directly without reference having to be made to tables. The rules given for forecasting weather may of course have to be modified in different climates, and it would be an interesting occupation for any amateur meteorologist to test them.

A dew-point hygrometer is supplied by the same makers, which is an interesting modification of the ether hygrometer, the film of moisture being deposited on half of a bright metal mirror which forms one side of the ether chamber, the other half of the mirror, which is not cooled, is separated by a narrow slit cut in the metal, so that the division between the dewed and clear surfaces is extremely sharp and the formation of a film of moisture easily observed.

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THE RECENT GREAT HEAT.

IN England the month of July is the warmest of the year, and very conspicuously marks the height of a relatively short summer, and it is accordingly in that month that the highest average temperature day and night prevails.

Spells of very hot weather—or, as they are popularly termed, "~~heat waves~~"—however, which are the result of peculiar meteorological conditions allowing the sun's rays to penetrate freely through the atmosphere over a wide area and to produce their maximum heating effect upon the land, are by no means confined to the month of July, but occur frequently in an intense form during August, and occasionally as early as June or as late as September. When a period of great heat occurs early in the autumn, as in the present year, it assumes special prominence in the annals of meteorology, not only because the temperature during it is so much in excess of the normal, but also because it occurs at a time when ordinarily the mean daily temperature begins to decline rapidly with the approaching departure of the vertical sun from the northern hemisphere; and it is a safe deduction to draw that however great the heat may be in the equinoctial month of September, it would have been greater still in the previous June or July had precisely the same atmospheric and surface conditions then prevailed.

The most noteworthy features of the recent hot weather were the exceptionally high day temperatures and the low relative humidities associated with them. The shade maximum of $94^{\circ}0$ at Camden Square on September 2nd, as recorded by the Glaisher screen thermometer, is the highest September reading since 1858, when observations were commenced, and on only three other occasions has this temperature been exceeded or equalled, namely, on July 16th, 1900 ($95^{\circ}2$ F.), July 25th, 1900 ($94^{\circ}0$ F.), July 15th, 1881 ($94^{\circ}6$ F.)

The following are some of the temperatures recorded at Camden Square during the very hot weather; the 9 a.m. and maximum readings being compared with the mean of the averages for August and September :—

	9 a.m. Shade Temp.	Diff. of 9 a.m. Temp. from Average.	Max. Shade Temp.		Min. Shade Temp.	Max. Solar Temp. (black bulb in vacuo).
				Diff. from Average.		
Aug. 30, 1906 ...	82.8	+ 2.3	84.8	+14.9	49.5	119.6
" 31, " ...	74.7	+14.2	93.2	+23.3	54.4	130.5
Sept. 1, " ...	80.0*	+19.5	92.0	+22.1	58.7	126.0
" 2, " ...	73.5	+13.0	94.0	+24.1	57.6	131.5
" 3, " ...	74.7	+14.2	89.5	+19.6	56.8	129.4

* $3^{\circ}0$ above previous highest September reading.

The only other occasions with maximum shade temperatures exceeding 90° in September were in 1868 with $91^{\circ}0$ on 7th, and in 1898 with $91^{\circ}2$ on 8th.

During the 48 years 1858-1906, the maximum shade temperature has exceeded 90° on 41 days, of which 23 have been in July, 10 in August, 4 in June and 4 in September; and there have been only two instances of maximum shade temperatures above 90° on three successive days, viz., August 16th-18th, 1893, with maxima $90^{\circ}\cdot7$, $92^{\circ}\cdot7$ and $93^{\circ}\cdot6$ respectively, and August 31st-September 2nd, 1906, with maxima $93^{\circ}\cdot2$, $92^{\circ}\cdot0$, $94^{\circ}\cdot0$ respectively. In July, 1868, however, there were 4 days with maximum shade temperatures over 90° , and in July, 1900, there were 5, the reading of $95^{\circ}\cdot2$ on the 16th of the latter month being the highest temperature ever registered at Camden Square.

The recent heat has been very great in the north-midland counties, and the highest shade temperature that has come before our notice was 96° at Bawtry, in Nottinghamshire, on September 2nd. Even in Scotland temperatures above 80° were common. At the Edinburgh Observatory a maximum of 85° was recorded on August 31st, and it is probable that in the interior of southern Scotland higher temperatures still prevailed, a reading of $88^{\circ}\cdot6$ being actually recorded at the Coats Observatory, Paisley.

The prolonged heat and drought of the past summer culminating at the end of August in the abnormal weather above discussed, has, of course, been very trying to dwellers in town and country alike, and in many rural districts serious apprehensions of water and milk famine have been recently entertained; but with these disadvantages it must nevertheless be admitted that it is in seasons like the one just passed when the sun's rays strike with dazzling brilliancy upon a browned and glowing country-side, that the full glory of summer is best felt.

We print below a few of the numerous letters that have reached us upon the extreme heat.

Max. Shade Temp.,	Aug. 31st	.....	$92^{\circ}\cdot1$
"	"	Sept. 1st	 $93^{\circ}\cdot4$
"	"	Sept. 2nd	 $93^{\circ}\cdot0$

$93^{\circ}\cdot4$ is the highest recorded here since observations commenced in 1884. In August, 1893, there were three consecutive days with temp. of 90° or upwards—but not so high as these.

G. SEARLE.

30, Edith Road, West Kensington, W., Sept. 2nd, 1906.

The following table shows the exceptionally high temperatures recorded here during the period August 31st to September 3rd, 1906. All the instruments are standard ones with Kew certificates.

	Shade Max.	Shade Min.	Solar Radiation (black bulb in vac.)
August 31st	$92^{\circ}\cdot0$	$63^{\circ}\cdot0$	$141^{\circ}\cdot8$
September 1st	$92^{\circ}\cdot1$	$62^{\circ}\cdot2$	$140^{\circ}\cdot2$
" 2nd	$94^{\circ}\cdot6$	$59^{\circ}\cdot8$	$148^{\circ}\cdot0$
" 3rd	$89^{\circ}\cdot4$	$60^{\circ}\cdot1$	$136^{\circ}\cdot6$

SPENCER C. RUSSELL.

Parkside, Ashley Road, Epsom, Surrey, Sept. 4th, 1906.

The maximum shade temperatures during the last four days as recorded with verified thermometers in Stevenson screen are as follows :—

August 31st.....	94°·6
September 1st.....	94°·3
„ 2nd	94°·6
„ 3rd	91°·6

WM. B. BUTLER.

Alca, Reservoir Road, Old Southgate, N., 4th Sept., 1906.

The relative humidities recorded during the last few hot days seem low for this country, and the following figures may be of interest :—

		Dry.		Wet.		Dew Point.		Relative Humidity.
Aug. 31st,	9 a.m.....	75·5	...	64·6	...	56·9	...	52
	1 p.m.....	90·7	...	69·1	...	55·6	...	31
	Max.	91·8						
Sept. 1st,	Min.....	50·2						
	9 a.m.	78·1	...	66·5	...	58·6	...	51
	1 p.m.....	91·3	...	67·8	...	52·9	...	27
	Max.	93·0						
	3 p.m.	91·7	...	67·0	...	52·2	...	26
Sept. 2nd,	Min.....	49·9						
	9 a.m.....	75·2	...	65·5	...	58·5	...	56
	1 p.m.	91·6	...	67·3	...	52·3	...	26
	Max.	93·0						
	3 p.m.....	92·2	..	67·7	...	52·5	...	25
Sept. 3rd,	Min.....	52·2						

A temperature of 90° had not previously been recorded here since observations commenced in 1878, but it seems probable that this figure was reached in July and August, 1876.

H. MELLISH.

Hodsock Priory, Worksop, 3rd Sept., 1906.

I beg to send you the readings of our shade maximum temperature, the highest I have ever registered since regular observations were begun in 1871 :—

August 31st	92°·0
September 1st	94°·0
„ 2nd	94°·0
„ 3rd	89°·0

There are a few clouds floating about this afternoon—the first for several days.

JOHN MATHISON.

Addington, 3rd September, 1906.

TEMPERATURE FOR AUGUST, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				No. of Nig- ator below	
					Max.		Min.		Shade.	Gra.
					°	Date.	°	Date.		
Camden Square.....	London.....	51 32	0 8	111	93.2	31	45.7	29	0	0
Tenterden.....	Kent.....	51 4	0 41	190	90.0	31	47.0	20	0	0
West Dean.....	Hampshire.....	51 3	1 38	137	88.0	30, 31	38.0	29	0	2
Hartley Wintney.....	".....	51 18	0 53	222	90.5	31	39.0	29	0	...
Hitchin.....	Hertfordshire.....	51 57	0 17	238	91.0	31	45.0	27	0	...
Winslow (Addington).....	Buckinghamshir.....	51 58	0 53	309	92.0	31	42.0	19	0	...
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	0 40	226	93.0	31	...	...	...	...
Brundall.....	Norfolk.....	52 37	* 1 26	66	...	...	...	...	...	...
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	80.7	31	40.2	29	0	0
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	78.0	31	50.7	18	0	0
Polapit Tamar [Launceston].....	".....	50 40	4 22	315	82.0	31	41.0	30	0	0
Bath.....	Somerset.....	51 23	2 21	67	88.2	31	46.0	29, 30	0	...
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	84.0	31	53.0	29	0	...
Church Stretton (Woolstaston).....	Shropshire.....	52 35	2 48	800	84.5	31	39.5	19	0	...
Bromsgrove (Stoke Reformatory).....	Worcestershire.....	52 19	2 4	225	89.0	31	40.0	29	0	...
Boston.....	Lincolnshire.....	52 58	0 1	25	90.0	31	46.0	28	0	...
Workshop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	91.8	31	40.6	30	0	1
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	90.0	31	47.0	18, 29	0	...
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	76.2	8	45.5	19	0	0
Wetherby (Ribston Hall).....	Yorkshire, W.R.....	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage.....	".....	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park).....	" E.R.....	53 45	0 20	6	91.0	31	44.0	28	0	0
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	82.5	31	47.0	26	0	...
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street).....	Pembrokeshire.....	51 48	4 58	95	79.6	31	42.0	30	0	0
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	88.0	29	45.0	18, 30	0	...
Llandudno.....	Carnarvon.....	53 20	3 50	72	78.0	31	51.5	19	0	0
Cargen (Dumfries).....	Kirkcubright.....	55 2	3 37	80	80.0	31	43.0	19	0	...
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	78.0	31	43.0	5†	0	0
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	80.6	31	45.8	19	0	0
Colmonell (Clachanton).....	Ayr.....	55 8	4 54	140	78.0	31	41.0	5	0	...
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	76.0	28	47.0	30	0	0
Tighnabruaich.....	Argyll.....	55 55	5 14	50	74.0	31	42.0	18	0	...
Mull (Quinish).....	".....	56 36	6 13	35	71.0	31	...	...	...	...
Dundee (Eastern Necropolis).....	Fife.....	56 28	2 57	199	79.2	31	43.0	19	0	...
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford).....	".....	57 8	2 7	120	81.0	31	40.0	18	0	...
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	70.0	29, 30	38.5	23	0	...
Castletown.....	Caithness.....	58 35	3 23	100	77.5	31	43.0	12, 16	0	0
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	78.0	31	51.0	9, 17	0	...
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	74.5	7	42.0	19	0	...
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	70.0	1, 3, 12	44.0	18	0	...
Carlow (Browne's Hill).....	Carlow.....	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	77.0	31	49.1	19, 30	0	0
Ballinasloe.....	Galway.....	53 20	8 15	160	78.0	31	41.0	19†	0	...
Clifden (Kylemore House).....	".....	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Ennisceoe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...	...
Seaford.....	Down.....	54 19	5 50	180	74.6	5, 22	45.0	18	0	0
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	80.0	31	46.0	18	0	...

† and 25, 30. ‡ and 30, 31.

RAINFALL FOR AUGUST, 1906.

Ver. 1870-99.	RAINFALL OF MONTH.					RAINFALL FROM JAN. 1.				Mean Annual 1870- 1899.	STATION.
	1906.	Diff. from Av. in.	% of Av.	Max. in 24 hours.	No. of Days	Aver. 1870-99.	1906.	Diff. from Aver. in.	% of Av.		
n.	in.			in. Date.		in.	in.			in.	
33	·87	-1·46	37	·29 17	8	15·45	12·96	-2·49	84	25·16	Camden Square
37	·61	-1·76	26	·17 24	6	16·18	13·33	-2·85	82	28·36	Tenterden
60	·73	-1·87	28	·23 25	9	17·83	17·40	-·43	98	29·93	West Dean
09	1·13	-·96	54	·33 13	11	16·06	14·38	-1·68	90	27·10	Hartley Wintney
26	·88	-1·38	39	·24 24	9	15·07	13·89	-1·18	92	24·66	Hitchin
53	1·16	-1·37	46	·33 2	10	16·58	14·64	-1·94	88	26·75	Addington
40	·79	-1·61	33	·27 13	8	15·63	15·09	-·54	96	25·39	Westley
19	1·25	-·94	57	·27 8	10	15·01	17·56	+2·55	117	25·40	Brundall
18	·79	-2·39	25	·20 24	13	22·32	23·34	+1·02	105	39·00	Winterbourne Stptn
91	1·91	-1·00	66	·42 1	13	20·69	18·05	-2·64	87	35·00	Torquay
19	2·91	-·28	91	·77 1	18	21·57	24·52	+2·95	114	38·85	Polapit Tamar
96	1·84	-1·02	66	·62 15	13	18·82	16·70	-2·12	89	30·75	Bath
83	·94	-1·89	33	·27 3	10	18·56	15·58	-2·98	84	29·85	Stroud
24	2·69	-·55	83	·87 7	15	20·21	17·00	-3·21	84	33·04	Woolstaston
46	·96	-1·50	39	·30 24	10	15·41	13·87	-1·54	90	24·50	Bromsgrove
25	2·39	+·14	106	·95 8	11	14·45	13·56	-·89	94	23·30	Boston
31	1·46	-·85	63	·39 24	14	15·63	12·20	-3·43	78	24·70	Hodsock Priory
42	·92	-1·50	38	·30 24	14	16·53	13·12	-3·41	79	26·18	Derby
36	6·57	+2·21	151	1·38 16	19	25·23	31·24	+6·01	124	42·43	Bolton
59	2·85	+·26	110	·60 10	15	16·83	16·36	-·47	97	26·06	Ribston Hall
43	5·10	-·33	94	·81 15	20	36·87	42·16	+5·29	114	60·96	Arneliffe Vic.
81	2·04	-·77	73	·60 24	17	16·55	14·10	-2·45	85	27·02	Hull
14	3·42	+·28	109	·83 24	22	17·40	17·80	+·40	102	27·99	Newcastle
23	12·93	+1·70	115	2·65 12	22	77·96	84·80	+6·84	109	132·68	Seathwaite
52	3·47	-1·05	77	·70 24	20	25·23	28·02	+2·79	111	42·81	Cardiff
04	6·74	+2·70	167	1·78 1	16	27·41	31·25	+3·84	114	47·88	Haverfordwest
60	4·41	-·19	96	·66 12	17	26·46	30·96	+4·50	117	45·41	Gogerddan
86	4·14	+1·28	145	1·37 2	18	17·65	20·68	+3·03	117	30·98	Llandudno
10	8·74	+4·64	213	1·62 2	18	26·15	31·17	+5·02	119	43·43	Cargen
42	5·67	+2·25	166	·82 12	21	20·56	22·50	+1·94	109	33·04	Riddell House
...	5·08	...	...	·95 2	18	...	19·80	...	...	...	Edinburgh
98	3·48	-·50	87	·77 24	18	26·11	24·86	-1·25	95	44·85	Colmonell
79	5·28	+1·49	140	·90 10	23	22·09	25·53	+3·44	116	35·80	Glasgow
13	4·91	-·22	96	·60 2, 21	21	34·11	40·64	+6·53	119	57·90	Tighnabruaich
84	3·55	-1·29	73	·58 19	21	33·06	30·83	-2·23	93	57·53	Quinish
08	4·65	+1·57	151	1·20 2	21	18·20	16·40	-1·79	90	28·95	Dundee
83	2·87	-·96	75	...	...	21·66	21·48	-·18	99	36·07	Braemar
22	3·56	+·34	111	·71 2	18	19·93	20·05	+·12	101	33·01	Aberdeen
07	3·15	+·08	103	·57 24	20	18·33	19·29	+·96	105	29·37	Cawdor
19	4·75	+·56	113	1·15 2	13	32·69	35·15	+2·46	107	50·00	Invergarry
91	4·94	-1·97	71	·60 19	23	49·41	59·66	+10·25	121	86·59	Bendamp
65	3·37	+·72	127	·41 24	18	18·92	25·01	+6·09	132	31·60	Dunrobin Castle
...	2·76	...	...	·77 3	22	...	23·23	...	...	...	Castletown
92	2·84	-2·08	58	·31 24	20	34·90	29·60	-5·30	85	58·11	Killarney
71	2·34	-1·37	63	·71 24	13	24·00	21·01	-2·99	88	39·30	Waterford
79	3·46	-·33	91	·52 1	21	20·85	24·85	+4·00	119	33·47	Hurdlestown
51	2·04	-1·47	58	·42 24	14	21·56	18·36	-3·20	85	34·44	Carlow
02	1·76	-1·26	58	·38 3	17	17·53	15·42	-2·11	88	27·75	Dublin
96	4·07	+·11	103	·79 1	25	23·19	26·36	+3·17	114	37·04	Ballinasloe
90	5·85	-2·05	74	·90 14	23	48·34	46·85	-1·49	97	80·23	Kylemore House
57	4·53	-·04	99	·84 23	21	29·90	33·97	+4·07	114	50·50	Ennisceoe
52	3·85	+·33	109	·79 24	20	23·84	21·78	-2·06	91	38·61	Seaforde
94	5·93	+1·99	151	·74 24	23	24·48	28·97	+4·49	118	41·20	Londonderry
03	4·43	+·40	110	·90 1, 24	24	23·28	27·67	+4·39	119	37·85	Omagh

SUPPLEMENTARY RAINFALL, AUGUST, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	·74	XI.	Rhayader, Tyrmynydd	5·65
„	Ramsgate, West Cliff Villas	·63	„	Lake Vyrnwy	6·83
„	Hailsham	1·44	„	Llangyhanaf, Plás Draw	2·58
„	Crowborough, Uckfield Lodge	1·71	„	Criccieth, Talarvor	6·30
„	Osborne, Newbarn Cottage	·87	„	Llanberis, Pen-y-pass	16·62
„	Emsworth, Redlands	1·37	„	Lligwy	5·47
„	Alton, Ashdell	1·91	„	Douglas, Woodville	4·38
„	Newbury, Welford Park	·90	XII.	Stoneykirk, Ardwell House	4·11
III.	Harrow Weald, Hill House	·81	„	Dairy, The Old Garroch	6·57
„	Oxford, Magdalen College	·86	„	Langholm, Grove Road	8·62
„	Bloxham Grove	1·00	„	Moniaive, Maxwellton House	6·33
„	Pitaford, Sedgebrook	·82	XIII.	N. Esk Reservoir [Penicuik]	6·55
„	Huntingdon, Brampton	1·02	XIV.	Maybole, Knockdon Farm	4·90
„	Wisbech, Bank House	2·28	XV.	Campbeltown, Witchburn	3·79
IV.	Southend Water Works	·40	„	Inveraray, Newtown	6·28
„	Colchester, Lexden	·45	„	Ballachulish House	6·75
„	Newport, The Vicarage	·91	„	Islay, Eallabus	4·16
„	Rendlesham	·46	XVI.	Dollar Academy	5·61
„	Swaffham	2·10	„	Loch Leven Sluice	5·57
„	Blakeney	1·74	„	Balquhider, Stronvar	...
V.	Bishops Cannings	1·55	„	Perth, Pitcullen House	4·48
„	Ashburton, Druid House	2·84	„	Coupar Angus Station	4·65
„	Okehampton, Oaklands	2·74	„	Blair Atholl	4·12
„	Hartland Abbey	2·32	„	Montrose, Sunnyside Asylum	3·91
„	Lynmouth, Rock House	2·90	XVII.	Alford, Lynturk Manse	3·31
„	Probus, Lamellyn	2·22	„	Keith Station	3·66
„	Wellington, The Avenue	1·33	XVIII.	N. Uist, Lochmaddy	...
„	North Cadbury Rectory	2·23	„	Alvey Manse	4·67
VI.	Clifton, Pembroke Road	2·63	„	Loch Ness, Drumnadrochit	3·16
„	Moreton-in-Marsh, Longboro'	1·30	„	Glencarron Lodge	6·48
„	Rosa, The Graig	·91	„	Fearn, Lower Pitkerrie	3·81
„	Shifnal, Hatton Grange	1·59	XIX.	Invershin	3·34
„	Cheadle, The Heath House	2·11	„	Altnaharra	3·24
„	Coventry, Kingswood	1·05	„	Bettyhill	2·17
VII.	Market Overton	·84	„	Watten Station	1·82
„	Market Rasen	2·19	XX.	Dunmanway, The Rectory	3·72
„	Bawtry, Hesley Hall	1·21	„	Cork	1·47
VIII.	Neston, Hinderton	2·76	„	Darrynane Abbey	3·60
„	Southport, Hesketh Park	2·96	„	Glenam [Clonmel]	1·88
„	Chatburn, Middlewood	4·57	„	Ballingarry, Gurteen	2·69
„	Cartmel, Flookburgh	4·66	„	Miltown Malbay	4·84
IX.	Langsett Moor, Up. Midhope	2·72	XXI.	Gorey, Courtown House	1·99
„	Scarborough, Scalby	2·69	„	Moynalty, Westland	4·11
„	Ingleby Greenhow	2·38	„	Athlone, Twyford	3·97
„	Mickleton	2·82	„	Mullingar, Belvedere	2·64
X.	Bardon Mill, Beltingham	4·71	XXII.	Woodlawn	4·75
„	Ewesley, Fallowlees	5·16	„	Westport, Murriak Abbey	3·79
„	Ilderton, Lilburn Cottage	4·48	„	Collooney, Markree Obsy	4·59
„	Keswick, York Bank	5·16	XXIII.	Enniskillen, Portora	...
XI.	Llanfrehfa Grange	2·51	„	Warrenpoint, Summer Hill	4·85
„	Treherbert, Tyn-y-waun	6·84	„	Banbridge, Milltown	4·09
„	Carmarthen, The Friary	5·17	„	Belfast, Springfield	5·47
„	Castle Malgwyn [Llechryd]	5·49	„	Bushmills, Dundarave	3·98
„	Plynlimon	8·75	„	Stewartstown, The Square	4·33
„	Tall-y-llyn	8·00	„	Killybegs	6·03
„	New Radnor, Ednol	2·54	„	Horn Head	5·53

METEOROLOGICAL NOTES ON AUGUST, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Another dry and warm month, being, with two exceptions, the warmest August in the record of 49 years and $3^{\circ}\cdot7$ more than the average. A heavy TS on the 2nd brought little R, but there was a magnificent display of lightning lasting for several hours. Brilliant weather at the beginning and end of the month, but unsettled in the middle, when the aspect at times became very threatening. Mean temp. $65^{\circ}\cdot8$. Duration of sunshine $196\cdot9^*$ hours and of R $7\cdot6$ hours.

DORKING.—Month has continued dry and very hot. Harvest operations were finished by 25th, an unusually early date.

OSBORNE.—Fine and warm generally, with very little R.

WINTERBOURNE STEEPLTON.—A very dry August; smallest R since record began in 1893, and $2\cdot39$ in. below the average. Mean temp. about 1° above average.

TORQUAY.—Mean temp. $62^{\circ}\cdot9$, or $1^{\circ}\cdot4$ above average. Sunshine $224\cdot5^*$ hours, or $18\cdot0$ hours above the average.

NORTH CADBURY RECTORY.—1st to 25th generally cloudy, warm and humid; 26th to 31st brilliant and increasingly hot. First summerlike August since 1899. R least since 1900. No T or L.

ROSS.—Very dry; R $1\cdot42$ in. Max. temp. $91^{\circ}\cdot5$ on 31st; min. $42^{\circ}\cdot1$ on 30th.

WORKSOP, HODSOCK PRIORY.—Mean temp. higher than that of last 27 Augusts except that of 1893; August, 1899, had warmer days but a lower mean. Max. temp. $91^{\circ}\cdot8$ on 31st, min. $40^{\circ}\cdot6$ on 30th. R $\cdot35$ in. below the average.

BOLTON.—Temperature above normal; sunshine above average, only one day being sunless. R $2\cdot21$ in. above average. Severe TSS on 14th and 15th.

SOUTHPORT.—Sunny and warm; mean temp. $61^{\circ}\cdot2$ or $1^{\circ}\cdot9$ above average. Total sunshine $208\cdot8$ hours, or $28\cdot7$ hours above average. Total duration of R $40\cdot8$ hours; amount of R $2\cdot96$ in. at Hesketh Park, $3\cdot70$ in. at Birkdale, the difference being due to a TS. Much ozone.

LILBURN.—Very unsettled; R excessive. Frequent TSS; very severe TS on night of 2nd, with loss of life. Hot spell set in on 28th.

CARMARTHEN.—Unsettled and changeable during first three weeks, but very hot during last few days. Corn crops much injured by heavy R. Grass plentiful.

HAVERFORDWEST.—Rainfall considerable; on 1st, 2nd and 12th very heavy falls occurred. High temp. towards end of month with much fog. Barn crops very good, but potato disease very prevalent.

DOUGLAS.—Variable weather, with only a few days of real summer, and unusual prevalence of sea fog up to 9th, then wet, cold and gloomy till 24th; last week very beautiful, with brilliant sunshine and high temp. Harvest work made great progress.

DUMFRIES.—Wettest August since observations commenced in 1860. Heavy R on 2nd, accompanied by severe T and L. Harvest operations sadly delayed. Potato disease very prevalent; grass abundant.

ABERDEEN.—First three weeks wet, with little sunshine; last week dry and clear with max. temperature in shade from 75° to 81° .

CASTLETOWN.—Damp and cloudy, with more fog but less R than usual in August. Last few days of month very close and warm.

BROADFORD, HURDLESTOWN.—Damp, warm and muggy. Last few days very fine and of great use to farmers.

DUBLIN.—A warm but changeable and showery month. Last week was settled, summerlike and very warm. Mean temp. $63^{\circ}\cdot1$. TSS on 3rd and 16th; H on 3rd.

* Campbell-Stokes.

Climatological Table for the British Empire, March, 1900.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.	Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
	°		°			°		0-100	°	°	inches		
London, Camden Square	65·1	7	27·3	23	49·0	35·8	36·9	83	103·2	21·7	1·08	17	5·7
Malta.....	73·2	22a	43·1	23	83·3	50·6	48·0	79	...	37·4	·26	4	3·3
Lagos.....	93·0	22b	72·0	7	90·7	78·6	75·1	67	142·0	66·0	1·11	4	4·6
Cape Town.....	97·3	2	52·1	15	77·5	60·3	57·0	68	...	...	·73	6	4·1
Durban, Natal.....	89·1	15	61·2	3	81·4	66·0	...	...	146·3	...	4·61	17	5·7
Johannesburg.....(?)	82·0	4	43·9	29	70·4	52·2	52·8	83	154·2	39·3	3·41	13	4·5
Mauritius.....	88·5	3	69·7	26f	85·2	73·7	73·5	85	157·2	64·6	11·08	19	8·1
Onsoutta.....	92·9	29c	51·7	1	86·2	67·7	66·6	72	157·3	47·2	2·08	3	4·2
Bombay.....	90·8	2	67·7	13	94·4	71·5	67·8	73	139·2	59·9	·00	0	1·4
Madras.....	92·4	19	67·7	3	88·5	71·6	70·9	77	145·1	64·1	·00	0	2·3
Kodaikanal.....	74·2	26i	46·9	3	69·0	50·7	44·9	60	141·7	34·4	2·79	4	2·3
Colombo, Ceylon.....	93·4	1	72·8	2,3	89·4	75·9	73·4	78	154·0	69·0	4·42	10	3·8
Hongkong.....	80·1	21	48·2	7	65·9	58·1	56·0	79	129·1	...	2·63	15	8·7
Melbourne.....	90·0	9	45·7	4	73·6	54·7	53·0	71	147·0	38·1	3·79	11	5·3
Adelaide.....	93·7	19	48·0	22	78·1	58·3	52·8	60	152·1	43·0	2·36	7	5·0
Coolgardie.....	100·0	8	44·9	17	87·3	58·6	48·3	42	157·0	38·2	·04	1	1·6
Sydney.....	91·0	2	53·0	15	74·6	61·6	57·7	72	182·1	48·1	4·23	29	5·9
Wellington.....	71·8	5	40·0	27	63·1	50·9	49·3	81	125·0	35·0	3·72	12	7·0
Auckland.....	74·0	2d	40·0	8, 28	68·5	55·7	54·3	76	139·0	40·0	1·80	12	5·4
Jamaica, Negril Point..	88·6	18	65·2	20	84·3	69·9	69·7	78	...	...	5·36	13	...
Trinidad.....	99·0	24e	60·0	27	89·7	66·8	69·8	78	165·0	58·0	·73	5	...
Grenada.....	86·4	13	70·4	20	84·4	72·8	67·3	69	150·0	...	1·59	15	3·4
Toronto.....	49·7	27	0·2	23	32·6	21·0	21·0	79	76·0	-5·5	2·55	14	6·6
Fredericton.....	52·3	30	-15·3	19	36·4	10·2	9·0	53	...	...	5·00	12	4·6
Winnipeg.....	53·4	29	-19·5	13	27·1	5·0	...	...	...	...	·54	5	3·9
Victoria, B.C.....	63·0	8	21·2	15	51·7	37·2	...	...	...	...	·67	9	6·3
Dawson.....	48·0	29	-16·0	18	22·5	1·2	...	...	...	...	·22	3	3·3

a and 27. b and 23, 21. c and 30. d and 14, 15. e and 30. f and 31.

MALTA.—Adopted mean temp. of air 55°·6, or 0°·6 above the average. Mean hourly velocity of wind 11·1 miles, or 0·9 below average. Mean temp. of sea 61°·0.

Mauritius.—Mean temp. of air 1°·3, dew point 2°·9, and E 1·86 in. above averages. Mean hourly velocity of wind 7·3 miles, or 3·1 below average.

MADRAS.—Temperature below the average. Bright sunshine 248·4 hours.

KODAIKANAL.—Bright sunshine 243 hours.

COLOMBO.—Mean temp. of air 82°·6, or 0°·5 above, of dew point 0°·5 above, and E 27 in. below, averages. Mean hourly velocity of wind 6·1 miles.

HONGKONG.—Mean temp. of air 61°·6. Bright sunshine 71·0 hours. Mean hourly velocity of wind 16·1 miles.

Adelaide.—Mean temp. of air 68°·8, or 1°·3 below, and E 1·32 in. above, averages.

Sydney.—Mean temp. of air 1°·2 below, humidity 3°·9 below, and E 92 in. below, averages.

Wellington.—Mean temp. of air 3°·5 below, and E 33 in. above averages.

Auckland.—Mean temp. of air 3° below, and E a little more than half the average.

Trinidad.—E 1·19 in. below 43 years' average.

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THE RAINFALL OF THE SUMMER HALF YEAR, 1906.

THE summer of 1906 will be remembered for the great duration of sunshine, the moderate and in many places seriously deficient rainfall, and the remarkable period of great heat at the end of August and beginning of September. September was on this occasion undoubtedly a continuation of summer, and at its close it is appropriate to look back at the weather of the past half year viewed as a whole. To do so for the whole range of meteorological phenomena is at the moment impracticable, and we must content ourselves with one of the elements—rainfall.

Detailed Tables have been published in these pages every month, from which it is easy to see how the rainfall varies from place to place, and in what relation it stands to the average. Though the number of stations utilized is only 52, they are so well distributed that when meaned in groups they afford something more than an indication, if something less than an absolute measure, of the general fall for the larger regions of the British Isles. Derived from the published figures the general rainfall of the six months of the summer half year appears as follows, in percentages of the average :—

1906.	April.	May.	June.	July.	August.	Sept.	Six months.
England and Wales.....	54	132	101	36	74	39	69
Scotland.....	90	209	49	83	117	52	97
Ireland.....	90	147	66	81	89	40	82
British Isles.....	71	154	81	57	88	42	79

This little table shows that of the six months, only one had rainfall above the average over the whole country, viz.—May. England and Wales had also technically more than the average in June, and Scotland in August. The driest month was September, when the rainfall for the British Isles as a whole was less than half the average amount, and in England did not much exceed one-third of the average. The rainfall of September did not approach the average

at any station we have to consider, and only in the extreme west and north of Scotland, and in the extreme south-east of England, did it substantially exceed half the average. The driest area was in the south-east of Scotland and in the north-east of England, in a strip of country bordering the east coast from the Forth to the Humber. It was very dry also along the estuary of the Severn, and the Tables at the end of this number show several instances of extremely small falls. During September absolute droughts occurred at several stations, where no rain fell after the 16th; but neither absolute droughts nor partial droughts in the technical sense were so common as in many periods of six months with a greater total rainfall.

Each month of the six was characterized by patches of country which were relatively dry, and by patches which were relatively wet. In June, Scotland as a whole was dry, Ireland less dry, and England and Wales wet; but in every other month of the six the deficiency of rainfall was greatest in the south and east, while there was usually an excess in the north and west. Thus it happens that on taking the average of the six months, there was a distinct excess of rainfall in the extreme north of Scotland, and also in the south-west of Scotland, and in the extreme north of England. All the remainder of the British Isles was dry, but the west and north of Ireland, and the greater part of Wales, and the north of England, had not much less than the average fall. A marked deficiency was apparent only in the south-east of Ireland, and in the Midlands and south of England.

The result of this arrangement is that the area seriously affected by the reduced rainfall was practically confined to the centre and south of England. The following Table gives the total rainfall for the six months at each of the stations for which an average is available, the difference from the average in inches, and the ratio of the actual fall to the average, expressed as 100. The extremes shown are at Cargen, near Dumfries, where there was an excess of 3.70 in., the total fall being 120 per cent. of the average, and Torquay, where there was a deficiency of 7.25 in., the total fall being only 52 per cent. of the average, or scarcely more than one-half. At Derby the deficiency was 7.03 in., and as it has normally a somewhat lower rainfall than Torquay, the actual fall was only 49 per cent. of the average. Both these extreme cases were, fortunately for the country, not typical of any large area. A prolonged deficiency of rainfall in any place is one of the most serious misfortunes which can befall it, despite the vulgar error that labels rainless weather "fine." Great distress was occasioned in some parts of England, chiefly in the south-east, pasture being dried up to such an extent that cattle in many cases had to be fed by hand, as in a hard winter, and the supply of milk was seriously curtailed. At Basildon, near Billericay, in Essex, the shortage of water led to a terrible tragedy, a man and his wife having trespassed on a neighbour's land to obtain water

Rainfall of April—September, 1906.

STATION.	COUNTY.	Total Rainfall.	Difference from average, 1870-1896.	Percentage of average, 1870-1896.
Camden Square	London	7.72	-4.89	61
Tenterden	Kent	7.40	-5.30	58
West Dean	Hampshire	7.64	-6.03	56
Hartley Wintney	"	7.40	-4.82	61
Hitchin	Hertfordshire	8.02	-4.43	64
Winslow (Addington)	Buckinghamshire	8.64	-4.92	64
Bury St. Edmunds (Westley)	Suffolk	8.15	-5.08	62
Brundall	Norfolk	10.13	-2.64	79
Winterbourne Steepleton	Dorset	10.48	-5.82	64
Torquay (Cary Green)	Devon	7.98	-7.25	52
Polapit Tamar [Launceston]	"	10.84	-5.24	67
Bath	Somerset	9.42	-5.71	62
Stroud (Uptfield)	Gloucestershire	8.18	-6.65	55
Church Stretton (Woolstaston) ..	Shropshire	9.70	-6.16	61
Bromsgrove (Stoke Reformatory) ..	Worcestershire	8.95	-3.88	70
Boston	Lincolnshire	7.77	-4.48	63
Worksop (Hodsock Priory)	Nottinghamshire	7.02	-5.92	54
Derby (Midland Railway)	Derbyshire	6.72	-7.03	49
Bolton (Queen's Park)	Lancashire	19.20	-1.48	93
Wetherby (Ribston Hall)	Yorkshire, W.R.	9.41	-4.58	67
Arncliffe Vicarage	"	21.98	-3.92	85
Hull (Pearson Park)	" E.R.	8.97	-4.53	66
Newcastle (Town Moor)	Northumberland	13.67	-4.5	97
Borrowdale (Seathwaite)	Cumberland	50.54	-3.32	94
Cardiff (Ely)	Glamorgan	14.41	-5.13	74
Haverfordwest (High Street)	Pembroke	18.17	-1.59	92
Aberystwyth (Gogerddan)	Cardigan	17.31	-3.62	83
Llandudno	Carnarvon	11.42	-2.64	81
Cargen [Dumfries]	Kirkcudbright	22.39	+3.70	120
Lillisleaf (Riddell House)	Roxburgh	17.07	+1.15	107
Colmonell (Clachanton)	Ayr	15.77	-3.05	84
Glasgow (Queen's Park)	Renfrew	15.80	-1.52	91
Tighnabruaich	Argyll	26.77	+1.92	108
Mull (Quinish)	"	21.13	-2.82	88
Dundee (Eastern Necropolis)	Forfar	13.65	-4.97	93
Braemar	Aberdeen	13.52	-3.38	80
Aberdeen (Cranford)	"	14.61	-1.18	93
Cawdor (Budgate)	Nairn	12.81	-2.37	84
Invergarry	E. Inverness	20.52	-4.94	96
Loch Torridon (Bendamph)	W. Ross	32.96	-2.83	92
Dunrobin Castle	Sutherland	16.00	+1.85	113
Killarney (District Asylum) ..	Kerry	17.35	-6.18	74
Waterford (Brook Lodge)	Waterford	12.30	-4.87	72
Broadford (Hurdlestown)	Clare	15.71	-4.74	95
Carlow (Browne's Hill)	Carlow	10.13	-6.21	62
Dublin (Fitz William Square)	Dublin	8.83	-4.86	64
Clifden (Kylemore House)	"	29.57	-5.88	83
Crossmolina (Ennisceoe)	Mayo	20.08	-4.98	95
Seaford	Down	14.73	-3.32	82
Londonderry (Creggan Rea)	Londonderry	17.36	-1.54	92
Omagh (Edenfel)	Tyrene	17.67	-4.86	95

from a pond, when their own supply failed, were shot and killed, it is alleged, by the sons of the tenant of the farm, who had barely enough for his cattle.

From the beginning of the year the general rainfall for the nine months naturally shows a smaller deficiency than the six months considered above, because January was very wet everywhere. The approximate values for 1906 to the end of September are :—England and Wales 90 per cent. of the average, Ireland 92 per cent. of average, and Scotland 100 per cent. of average. It is obvious from these figures that it is too soon to say that 1906 is a dry year, for the three months to come may either increase or altogether wipe out the present deficiency.

THE METEOROLOGICAL OFFICE.

THE first Report of the Meteorological Committee for the year ending 31st March, 1906, has been published, and it contains a good deal that is new and interesting. The report occupies 40 pp., and the appendices fill about 100 pp. The Meteorological Committee it appears was appointed by a Treasury minute dated 20th May, 1905, and held five meetings during the year ; but a decision as to the form of incorporation to be ultimately adopted was not arrived at, the arrangement being that pending the settlement of the question of permanent premises the property of the Office should be vested in trustees. Otherwise the new Committee has carried on the organisation of the Office generally on the lines followed by the old Meteorological Council ; but various alterations, which we have noted from time to time, have been made, and others are foreshadowed.

Various economies have been effected by the abandonment of the Ben Nevis Observatories, the abolition of the paid Council, and by more favourable arrangements with the Admiralty, and out of the savings £500 per annum have been assigned to investigations in the upper atmosphere, the experiments being organized and controlled by Mr. Dines. The objects to be kept in view in this work are (1) the maintenance of a dépôt for the construction and testing of apparatus ; (2) the investigation of the upper air over the British Isles by a series of simultaneous ascents with kites and unmanned balloons, at three stations if possible, on the days fixed for the international ascents ; (3) the supply of apparatus for observations in the upper air for use at sea, and the instruction of the officers who may undertake such investigations.

The Committee has given attention to the question of collecting meteorological data from local authorities and private individuals, this being done not only to supply material for the official publications, but also to assist in forming a collection of meteorological data "for the purposes of scientific investigations, or the requirements of those interested in agriculture, sanitary science, or the

various industries which are affected by different conditions of weather."

Reference is made to the overlapping in the publication of monthly summaries by the various bodies concerned in collecting meteorological records in the British Isles. The Committee invited the Royal Meteorological Society and the Scottish Meteorological Society to send representatives to a Conference to endeavour to initiate a joint scheme for the collection and publication of results. One meeting of this Conference has been held and the Committee hopes that this will soon result in an agreement to the common advantage of all three institutions.

The report refers in guarded and diplomatic language to the difficulties and disabilities under which the Meteorological Office labours with regard to telegraphic service, but we who are untrammelled by the considerations which compel a public body to walk delicately in the presence of the Postmaster General, can say that the British public loses vastly more in the value of property damaged by storms—the warnings of which have been tied up and kept back by Post Office red tape—than it saves in preserving traditions of working which have grown dear to the official heart. The fishing interests in particular would do well in this matter to impress upon Parliament that the public is lord also of the Post Office. The humour of the situation is that the Post Office at present cheerfully receives and accepts payment for telegrams which it delivers after twelve, twenty-four, or even more hours; and we are told that "the representative of the Postmaster General, who went into this matter very carefully, was only able to suggest that the meteorological service should be fixed for such hours as to allow an adequate margin for the occasional pressure of ordinary business and other causes of telegraphic delay." Might he not have suggested with equal appropriateness that cyclonic storms approaching the British Isles should time their arrival so that the first indications of their proximity might be observed during the hours when it is convenient for telegraph operators to transmit and receive messages? A possible way of escape, which is not referred to in the Report, may ultimately be found through the telephone service, which curiously enough is not shut off like the telegraphs in most districts, at night or on Sundays.

A practical point of great importance is the question of the housing of the Meteorological Office. Negotiations are in progress for securing a new building on a site at South Kensington, belonging to the Government, or to the Commissioners for the Exhibition of 1851. The proximity of the University of London and the Museums is held, in the opinion of the Meteorological Committee, to outweigh the disadvantages of greater distance from "the lithographers, the city, and the docks," but the removal from Westminster, which has been a meteorological centre for many years, must cause inconvenience and regret to many other interests. There

is a tendency for the concentration of scientific as well as educational institutions in South Kensington, and the remoteness of the locality from the haunts of busy men will no doubt be counterbalanced by solid advantages.

The institution of monthly meteorological charts for the Indian Ocean and the Red Sea is announced, and a brief summary is given of the various scientific researches which have been promoted by the late Meteorological Council and the present Committee, researches all of them of great interest and likely to lead to practical results, and of a nature which certainly ought to be aided largely by public money.

The appendices contain correspondence with the Treasury on various points connected with the organization of the Meteorological Committee, and the work of the Meteorological Office, also lists of marine observers, and of observers at land stations, together with sundry other matters of routine. Space is saved, as compared with former reports, by the omission of the long list of additions to the Library, the more important of which are referred to in the body of the Report.

Altogether the record of the first year's work of the re-organized Office strikes us as extremely satisfactory, showing a spirit of progress, and a relaxation of the extreme formality which is so apt to impair the usefulness of public service.

RADIATION PHENOMENA IN SOUTH AFRICA.

By JAMES LYLE.

As the average height of the Orange River Colony is over 4000 ft., the surface practically bare, and the air excessively dry, all local phenomena dependent on radiation from the sun and from the ground must be striking, even if not novel. As your Magazine circulates throughout other parts of South Africa, where similar conditions prevail, a few notes on some such phenomena may interest some of your readers.

The sequence of the following phenomena is fairly constant, though relative intensities depend on the season of the year. As soon as the sun sets the temperature falls very rapidly, especially on the tops of the kopjes, which, as they are the remains of an old land surface, are often quite flat, with a slight dip. The cooled air flows down from them on to the present general surface of the land, by the same law as water flows. This is most noticeable when smoke is being produced on the top of the kopje. At Bloemfontein the military cantonments are on a kopje, and at sunset one can trace by the smoke a complete river system of cold air wending its way into the basin in which the city lies. Channel, tributaries, divides, are all distinctly marked. The hot air floats upward and in a few hours the air on the top of the kopje becomes several degrees

warmer than the air below. In consequence it is more comfortable to bivouac on a kopje than on the level. Young trees suffer more from frost in the valleys than on the kopjes. The transition is often quite marked, both vertically on ascending a kopje, and horizontally on passing through a river of cold air.

Recently it was my unfortunate experience to have to catch a train at 2.30 a.m., and to be roused again at sunrise. On looking to the west, towards a line of kopjes, I saw what on closer examination proved to be a mirage inverted. The text books give it another name but I think this is the best name for it. The kopjes were fully eight miles away and about 300 feet high. The light from them must have struck the base of the hot air which had risen the previous evening and being totally reflected gave us an inverted image of the kopjes, with the top of the kopje touching its own image. The phenomenon lasted about fifteen minutes.

By eight or nine o'clock when the sun has had time to heat the ground surface and the adjacent layer of air, often not so much as a foot in depth, we see the usual mirage where the images of kopjes and sky are seen under the real objects. On the field of Sannah's Post I have seen such a reflection of cattle only a few hundred yards distant. The reflecting layer seemed to be about the level of their knees as it was there that image and object touched. The movement of the hot air gave a quivering image such as one sees in pools whose surface is crossed by ripples. Later in the day, as this hot air gathers head, it bursts upward through the over-lying colder air in dust-whirls, rotating as accident decides, but always drifting up the slope of the heated land. The whirls vary in size from a few inches in diameter to a hundred feet, and in intensity from harmless spirals up to those which well merit the name of dust devils. They advance slowly at the rate of about six miles an hour as a maximum, but the speed of rotation is very great. Fifty or sixty miles an hour is quite common.

Near midday other ascending currents show themselves in the formation of Cumulus clouds, which, especially in summer, are a feature of the afternoons. As evening draws on the clouds settle down and disappear. This almost daily series of up and down currents seems by its rhythm to have a cumulative effect and at length to become unstable and to terminate in a violent afternoon squall of dust, thunder, lightning, rain and even hail.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

PHOTOGRAPHIC SUNSHINE RECORDERS.

I READ with concern the remarks on Photographic Sunshine Recorders which appear in your article, "Local Societies and Meteorology," on p. 142.

As I believe I am the originator of the photographic method, I may perhaps say that I think the remarks seem somewhat severe when applied to all photographic sunshine recorders.

The photographic method doubtless has defects, as also has the Campbell-Stokes burning method, but, I think, in all fairness both may claim to give faithful records of the duration of bright sunshine.

Referring more particularly to my own instrument, the official report of a comparison between it and the "Campbell-Stokes" recorder at the Kew Observatory in 1887 certified that, "after a month's trial, the results were practically identical, the difference between the two records being less than one per cent." These experiments were made when the "Jordan" recorder was first brought out, but since that date the instrument has been much improved, and the method of preparing the charts has likewise been modified so as to render them equally sensitive at all times and to ensure that only bright sunshine is recorded.

I may add that I have now no pecuniary interest in the instrument, the patent rights having long since lapsed.

JAMES B. JORDAN.

"Hayfield," Hythe, Kent, October 4th, 1906.

[We should be glad to have the opinions of our readers on the relative merits of the photographic and burning sunshine recorders. For our own part we feel that the action of the Meteorological Office in making the Campbell-Stokes instrument the standard for comparison between different stations renders it highly desirable that that form should be generally adopted. The ingenuity and simplicity of Mr. Jordan's recorder are beyond praise, and for comparing the sunshine of one day with another at the same station, so long as the sensitized paper retains its properties unimpaired no better instrument need be desired. The difficulty is that different supplies of the sensitized paper often differ in their degree of sensitiveness, so that the records vary in length for the same amount of sunshine. We are glad to learn that a method has been found for overcoming this difficulty, and suggest that a fresh series of comparisons between the Campbell-Stokes recorder and the Jordan recorder, furnished with cards prepared at different times and by different makers, should now be instituted.—ED. S.M.M.]

UNBROKEN RUN OF DAYS WITH SUNSHINE.

As an illustration of the exceptional summer of 1906, I give below the longest continuous run of sunny days in the last nine summers at Slough, Bucks :—

1898	.....	53	days	without	a	break.
1899	.....	70	„	„	„	„
1900	.....	64	„	„	„	„
1901	.....	105	„	„	„	„
1902	.....	34	„	„	„	„
1903	.....	71	„	„	„	„
1904	.....	80	„	„	„	„
1905	.....	60	„	„	„	„
1906	.....	119	„	„	„	„

RICHARD BENTLEY.

Upton, Slough.

[At Camden Square the number of consecutive days recording sunshine from June 16th to October 1st was 108.—ED. *S.M.M.*]

THE DROUGHT.

In case you think it worth publishing as a contrast to Mr. Horner's statistics of a remarkable drought in the south of England, I send you my rainfall return for the same three months in the same form :—

JUNE.	in	JULY.	in.	AUGUST.	in.
1	 '06	6	 '03	1	 '19
14	 '01	10	 '01	3	 '07
15	 '03	11	 '03	4	 '03
16	 '58	13	 '18	5	 '06
17	 '09	15	 '01	10	 '12
23	 '98	18	 '17	11	 '03
27	 '14	21	 '12	12	 '01
28	 1'40	22	 '02	13	 '02
		23	 '28	14	 '48
		26	 '20	15	 1'64
		28	 '47	16	 '28
				17	 '12
				20	 '01
				23	 '19
				24	 '67
				25	 '02
Totals	3'29		1'52		3'94
No. of days	8		11		16

Total for the 3 months, 8'75 in.

WALDEGRAVE.

Chewton Priory, Bath, September 21st, 1906.

THE GREAT HEAT.

To compare with other readings that appear in the current number of your Magazine you may be interested in the following records of my thermometers here (they are Kew certificated).

		max.	min.
Aug. 31	.....	89·9	58·0
Sept. 1	.....	86·1	56·8
„ 2	.....	88·9	57·9
„ 3	.....	91·4	59·0

I cannot help thinking the last maximum must constitute pretty well a record for this part of East Anglia where, however, my own observations have only covered 5 years; during this period my next highest reading was only 87·9 on August 4th, 1904. It is curious to observe that the heat did not culminate here until September 3rd, which was the hottest day. Generally, over England, this day seems to have been materially cooler than the preceding 3 days. Note also that the night minima were not excessively high.

Rookwood, Copdock, Ipswich, 24th Sept., 1906.

F. H. BLAND.

A CONTRAST IN SUMMER RAIN.

I ENCLOSE the total rainfall registered here for the four hottest months of the year, also for comparison's sake, that of three years ago. The low summer rainfall following a dry spring (March, April and May only yielding 3·90 inches), has been rather severe on surface rooting trees and shrubs.

	1906		1903
	in.		in.
June	1·36	.....	6·36
July	1·03	.....	6·36
Aug.	·40	.....	3·64
Sept.	1·60	.....	2·19
Totals	4·39		18·55

T. W. BACON.

Ramsden Hall, Billericay, 1st October, 1906.

METEOROLOGICAL NEWS AND NOTES.

AN INTERNATIONAL POLAR CONGRESS was convened at Brussels by the Belgian Government in the beginning of September. Most of the countries of Europe (the United Kingdom, Austria-Hungary and Norway being the only prominent exceptions) were officially represented, and various resolutions were drawn up to favour the resumption of Arctic and Antarctic exploration. Meteorology, as one of the sciences which has most to learn from polar exploration, was well to the front. Prof. Rykatcheff of St. Petersburg, M. Angot of Paris, M. Lancaster and M. Lecoq of Brussels, Prof. E. Hermann of Hamburg, Dr. Meinardus of Berlin, Prof. Von der Stok of de Bilt, Dr. H. R. Mill of London (representing the Royal Meteorological Society), and Mr. R. C. Mossman of Edinburgh, were amongst the meteorologists present.

A SEVERE TYPHOON burst upon Hong Kong on September 18th, causing the loss of several ships and a great many lives as well as doing much damage on shore. It is stated that no warning of this storm was issued by the Hong Kong Observatory, and that the Governor has appointed a Committee to inquire into the matter. A telegraph agency announces that the typhoon had been foreseen at the Jesuit Observatory at Zi-ka-wei, and warnings were issued, though no warning was sent to Hong Kong "because for years the Hong Kong Observatory has refused to exchange warnings with the Jesuit Observatories at Shanghai and Manila." Rumours of such a state of affairs have been heard before, and it is to be hoped that the Governor's Committee of Inquiry will settle the matter definitely. It is difficult to understand any circumstances which could justify the suspension of a free exchange of observations and warnings, and we must hope that the statements which have been published are erroneous.

DR. G. C. SIMPSON Lecturer on Meteorology in the University of Manchester has been appointed, we learn from *The Times*, assistant to the Director of Observatories under the Indian Government. Dr. Simpson's work in the study of the upper air by means of kites in the North Sea will be remembered by our readers, and he has assisted in establishing the kite observations in Derbyshire now being conducted by the University of Manchester.

DR. H. R. MILL WILL LECTURE ON "RAIN," for the Gilchrist Trust, in the last week of November, at the following towns:—Alfreton, on November 26th; Mansfield, on the 27th; Mexborough, on the 28th; Derby Dale, on the 29th; and Glusburn, on the 30th. He hopes to meet a number of the rainfall observers in those neighbourhoods, and if time permits to inspect some of the rain gauges.

ELECTRICAL RESISTANCE THERMOMETERS for meteorological work are referred to in *Technical Thermometry*, the last catalogue of the Cambridge Scientific Instrument Company, and an interesting diagram is given showing the curve of an open-wound thermometer of this type connected with a Callandar recorder. This curve represents the fluctuations of air-temperature at Cambridge in the squall of February 8th, 1906, and indicates a drop of 9° in less than ten minutes.

A METEOROLOGICAL ADVERTISEMENT issued by a tradesman in Cape Colony takes the form of a calendar for 1906, the centre of which is occupied by a table of the monthly rainfall of the locality for the years of the 20th century, 1906 being left blank, to be filled up as the year proceeds. Above appears a statement of the average rainfall of the summer and of the winter months, and below "The time to buy —'s pianos is winter or summer, wet or dry."

REVIEWS.

A First Report on the Relations between Climates and Crops. U.S. Department of Agriculture. Weather Bureau. By CLEVELAND ABBE. Washington: 1906. Size 9 x 6. Pp. 386. Price, \$1.50.

THIS report is a summary of the results of the best experimentalists and observers upon agricultural physics and plant physiology so far as these results were published up to 1891, and presents a rapid review of the condition of our knowledge up to that year respecting the influence of climate upon wild and cultivated plants.

The author indicates that there are three methods generally recognised as advancing our knowledge of climatic influences upon vegetable life, viz., the physiological, experimental and statistical methods—the last the least satisfactory—and he has accordingly availed himself of a large number of data resulting from investigations carried out at the Botanical Institute, Würzburg, Germany, and at the agricultural experimental stations and biological laboratories in Europe and America, and from statistics compiled by the United States Department of Agriculture.

The results of investigations carried out with a view to determine the relations of special crops to special features of climate and other influences are quoted at length, together with those of experimental work in connection with the influence of low temperatures upon plant life. It appears that warm thaws act very injuriously upon many plants, including wheat, when they have been frozen at very low temperatures, whereas cold thaws effect little damage. The same applies to the germination of seeds.

Much space is given in the report to the results of phenological observations, and tables are reproduced giving for 889 species of plants studied by Karl Fritsch during the years 1857—1861, at the Botanical Garden, Vienna, the average dates for the appearance of flowers and ripened fruit and the thermal constants connected with the manifestation of these phases of plant life. The discussion by Angot of a system of phenological observations organized in 1880 by the Central Meteorological Bureau of France is also summarized. In his discussion Angot by laborious processes finds numbers showing the connection between the leafing and flowering of different species of plants with the mean daily temperatures, the mean daily maximum temperatures, and the sums of mean daily temperatures and maximum daily temperatures. The relationship, however, is not a simple one, and the numbers varied somewhat from year to year. Some species seem to be more dependent as regards their date of flowering, &c., upon the sums of mean daily temperature, others upon the sums of maximum daily temperatures reckoning from above a certain limit.

In the accumulation of data of this nature we take it that it is always the *average individuals* of each species that are selected for observation by phenologists, not the earliest ones. According to

Angot, for example, May 6th is the average date for the first appearance of leaves and flowers on the oak in the latest districts of the north of France; this is *about* the 'date' for the south of England, but on the 30th of April in the south of England fully twenty-five per cent. of the oak trees in any given area are normally already leafing and flowering and a smaller percentage as early as the 20th, whilst as late as the 12th of May fully twenty-five per cent. remain with closed leaf and flower buds, and a smaller percentage are more backward still. We refer to this question as reports on phenological observations submitted to the public are not always clear as to what kind of individuals are selected for study. L.C.W.B.

Memoirs of the Geological Survey. England and Wales. The Water Supply from underground sources of Lincolnshire, 1904.

Do. do. of Suffolk, 1906.

Do. do. of the East Riding of Yorkshire, 1906.

London. Printed for H.M. Stationery Office by Wyman & Sons, and to be purchased from E. Stanford, London; John Menzies & Co., Edinburgh; Hodges, Figgis & Co., Dublin, or from any Agent for the sale of Ordnance Survey Maps.

FROM a meteorological point of view the chief interest of this new series of Water Supply Memoirs rests on the fact that each is accompanied by a map of the average annual rainfall of the district concerned. The maps, which were prepared by Dr. H. R. Mill from the data collected by the British Rainfall Organization, are published on the scale of 10 miles to an inch, and show the average rainfall for a period of 35 years from 1868 to 1902. There are not many records in any county which run unbroken through so long a period; but there are enough to enable the relative rainfall of each year to be deduced and thus furnish ratios by which the rainfall of short periods may be corrected to the long average. The counties in question exhibit no great range in rainfall, and it has been found possible to draw isohyets or lines of equal rainfall for successive intervals of $2\frac{1}{2}$ inches. The relation to configuration is perfectly clear in all cases where observations exist, and where data are wanting it was possible to sketch the most probable distribution of rain by reference to the features of physical relief.

The following summaries may be placed on record as likely to be of general interest.

Lincolnshire.—Average general rainfall 25·25 in.

Zone. in.	Sq. miles.	Per cent. of Total Area.	General Rainfall of Zone. in.
Below 22·5	34	1·3	22·25
22·5 to 25·0	1409	53·6	24·0
25·0 „ 27·5	898	34·2	26·0
27·5 „ 30·0	236	9·0	28·5
Above 30·0	51	1·9	30·25
Total	2628	100·0	25·25

Suffolk.—Average general rainfall 24.50 in.

Zone, in.	Sq. miles.	Per cent. of Total Area.	General Rainfall of Zone. in.
Below 25.0	970	65.2	24.3
Above 25.0	518	34.8	25.3
Total	1488	100.0	24.5

East Riding of Yorkshire.—Average general rainfall 27.40 in.

Zone, in.	Sq. miles.	Per cent. of Total Area.	General Rainfall of Zone. in.
Below 25.0	305	25.7	24.5
25.0 to 27.5	395	33.3	26.2
27.5 „ 30.0	228	19.3	28.5
30.0 „ 32.5	183	15.5	31.1
Above 32.5	73	6.2	33.5
Total	1184	100.0	27.4

The Fernley Observatory, Southport. Report and Results of Observations for the year 1905. By JOSEPH BAXENDELL, Meteorologist to the Southport Corporation. Southport: 1906. Size 10 × 7½. Pp. 30.

THIS report is a pattern which any town, desiring to establish a complete meteorological observatory, would do well to follow. The instruments are clearly described and the records carefully discussed. Special interest attaches to the underground temperatures which are measured at 1, 4, 10 and 20 ft. The annual mean of each of the four lay between 49°·4 and 49°·7. The minimum at 1 ft. and 4 ft. occurred in January, at 10 ft. in March and at 20 ft. in May; the maximum at 1 ft. and 4 ft. occurred in July, at 10 ft. in August and September, and at 20 ft. in October. The range of mean monthly temperature was 28°·8 at 1 ft., 20°·5 at 4 ft., 11°·2 at 10 ft., and 3°·3 at 20 ft. A valuable feature of the report is the series of tables giving the monthly means of the principal meteorological elements for each hour of the twenty-four. We congratulate Mr. Baxendell and the Corporation of Southport on a good report of an excellent year's work, the solid scientific value of which is assured by all the safeguards that could be applied.

The State of the Ice in the Arctic Seas, 1905. Copenhagen, 1906. Size 12½ × 9½. Pp. xx.

THIS abstract from the annual report of the Danish Meteorological Institute records a unique achievement in Arctic navigation in the successful navigation of the North West Passage for the first time, by Captain Amundsen. The English of the bilingual report is hardly up to its usual standard this year, and might have been improved by revision.

The National Physical Laboratory. Report of the Observatory Department for the year 1905. Teddington: 1906. Size $10\frac{1}{2} \times 7\frac{1}{2}$. Pp. 44.

THE Report of the Observatory Department is issued separately this year as it "appeals to a different class of workers to that interested in the Engineering and Physics Department," and we welcome the change. The separate publication of the work of an observatory, a very large part of the work of which is the testing of Meteorological instruments, throws into relief the absence from the General Board of the National Physical Laboratory of any representative of any meteorological institution, or of any individual who is associated with meteorology. We have more than once had to refer to the contempt in which meteorology is held in this country by the bodies which control the nomination of such boards, and in particular to the tacit assumption that meteorology is an inferior branch of science. The subject is one on which we fear more must be said; but not on this occasion.

The instruments tested in 1905 included 35 rain gauges, 54 rain measuring glasses, 3 sunshine recorders, 244 barometers, 3,626 meteorological thermometers and 44 solar radiation thermometers. The appendix to Dr. Chree's report includes tables of meteorological data including atmospheric electricity, and also of magnetic and seismological observations, the magnetic data referring to the observations at Falmouth and Valencia as well as to Kew.

Gyroscopes and Cyclones. By F. J. B. CORDEIRO. Reprinted from American Journal of Mathematics. Vol. 28. No. 3. [No place of publication or date.] Size $12 \times 9\frac{1}{2}$. Pp. 14.

IN this paper a cyclone is treated dynamically as a gyroscope, in other words as a rotating disc, moving on the surface of a rotating sphere. Some startling results follow, and the author suggests that moving cyclones tend to accelerate the Earth's rotation by the cumulative effect of their movement always in one direction, and that they may exercise a disturbing influence on the Earth's axis, accounting, in part at least, for the slight variations in latitude which have been detected by astronomers.

Niederschlag, Abfluss und Verdunstung auf den Landflächen der Erde. [Precipitation, Run-off and Evaporation on the land-surfaces of the Earth.] Von RICHARD FRITZSCHE. Halle: 1906. Size $9\frac{1}{2} \times 6\frac{1}{2}$. Pp. 56.

A THESIS written for the Doctors' degree in the University of Halle. It deals with data collected by a number of observers and contains references to a good deal of the literature of the subject, giving tables of the rainfall of the Earth's surface in all latitudes.

TEMPERATURE FOR SEPTEMBER, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				No. of Nights ator below 32°	
					Max.		Min.		Shade.	Grass.
					°	Date.	°	Date.		
Camden Square.....	London.....	51 32	0 8	111	94.0	2	39.0	28	0	0
Tenterden.....	Kent.....	51 4	0 41	190	92.0	2	41.5	28, 28	0	...
West Dean.....	Hampshire.....	51 3	1 38	137	87.0	1	29.0	28	4	11
Hartley Wintney.....	".....	51 18	0 53	222	93.6	1	30.5	26+	5	7
Hitchin.....	Hertfordshire.....	51 57	0 17	238	92.0	1	35.0	26+	0	...
Winslow (Addington).....	Buckinghamshir.....	51 58	0 53	309	94.0	1, 2	32.0	26+	3	5
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	0 40	226	93.5	3	38.0	29	0	...
Brundall.....	Notfolk.....	52 37	1 26	66	93.0	3	34.4	27	0	1
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	81.8	1	30.4	26	2	5
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	76.1	7	44.0	26	0	0
Polapit Tamar (Launceston).....	".....	50 40	4 22	315	81.4	1	28.8	26	1	4
Bath.....	Somerset.....	51 23	2 21	67	87.8	1	34.0	28	0	...
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	86.0	1, 2	45.0	26	0	...
Church Stretton (Woolstaston).....	Shropshire.....	52 35	2 48	800	86.5	1	36.0	25, 26	0	...
Bromsgrove (Stoke Reformatory).....	Worcestershire.....	52 19	2 4	225	90.0	1, 2	30.0	25, 27	4	...
Boston.....	Lincolnshire.....	52 58	0 1	25	89.0	1, 2, 3	36.0	28, 29	0	...
Workshop (Hodsock Priory).....	Nottinghamshire.....	52 22	1 5	56	93.0	1, 2	30.5	28	1	11
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	94.0	2	31.0	27	1	...
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	87.6	2	39.1	28	0	1
Wetherby (Ribston Hall).....	Yorkshire, W.R.....	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage.....	".....	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park).....	E.R.....	53 45	0 20	6	87.0	1	36.0	29	0	4
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	88.0	1	37.1	29	0	...
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street).....	Pembrokeshire.....	51 48	4 58	95	78.6	1	33.3	26	0	1
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	86.0	1	31.0	25	...	...
Llandudno.....	Carnarvon.....	53 20	3 50	72	87.0	1	44.0	23	0	...
Cargen (Dumfries).....	Kirkcudbright.....	55 2	3 37	80	86.0	1	32.0	29	1	...
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	86.0	1	30.0	23	4	7
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	85.3	1, 2	38.1	24	0	0
Colmonell (Clachanton).....	Ayr.....	55 8	4 54	140	84.0	1	31.0	28	2	...
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	82.0	2	36.0	30	0	7
Tighnabruach.....	Argyll.....	55 55	5 14	50	...	...	37.0	16, 28	0	...
Mull (Quinish).....	".....	56 36	6 13	35	82.0	2	...	...	...	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	83.5	2	37.9	17	0	...
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford).....	".....	57 8	2 7	120	82.0	1	32.0	23+	3	...
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	73.0	2	38.5	25	0	...
Castletown.....	Caithness.....	58 35	3 23	100	83.0	2	34.0	23, 25	0	1
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	81.0	2	40.5	10	0	...
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	74.0	6	34.0	26	0	...
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	72.0	1	40.0	15	0	...
Carlow (Browne's Hill).....	Carlow.....	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	77.8	2	41.0	26	0	0
Ballinasloe.....	Galway.....	53 20	8 15	160	...	...	...	...	...	...
Clifden (Kilemore House).....	".....	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Ennisecoe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...	...
Seaford.....	Down.....	54 19	5 50	180	72.0	1	37.0	27	0	1
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	82.0	1	36.0	28	0	...

RAINFALL FOR SEPTEMBER, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
Aver. 1870-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.	No. of Days		Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.		
in.	in.	in.	in.	in. Date.			in.	in.	in.	in.	in.	
2.29	1.75	— .54	76	.81 4	8		17.74	14.71	—3.03	83	25.16	Camden Square
2.62	1.70	— .92	65	.37 18	9		18.80	15.03	—3.77	80	28.36	Tenterden
2.58	.79	—1.79	31	.35 14	6		20.41	18.19	—2.22	89	29.93	West Dean
2.38	.81	—1.57	34	.27 14	9		18.44	15.19	—3.25	82	27.10	Hartley Wintney
2.26	1.13	—1.13	50	.39 14	10		17.33	15.02	—2.31	87	24.66	Hitchin
2.38	1.06	—1.32	45	.32 14	10		18.96	15.70	—3.26	83	26.75	Addington
2.49	1.21	—1.28	48	.41 13	9		18.12	16.30	—1.82	90	25.39	Westley
2.57	1.25	—1.32	49	.39 16	10		17.58	18.81	+1.23	107	25.40	Brundall
3.40	1.74	—1.66	51	.59 14	6		25.72	25.08	— .64	98	39.00	Winterbourne Stptn
3.05	.95	—2.10	31	.60 14	6		23.74	19.00	—4.74	80	35.00	Torquay
3.63	1.14	—2.49	31	.43 14	7		25.20	25.66	+ .46	102	38.85	Polapit Tamar
2.89	.76	—2.13	26	.23 14	6		21.71	17.46	—4.25	80	30.75	Bath
2.72	.65	—2.07	24	.25 14	6		21.28	16.23	—5.05	76	29.85	Stroud
2.74	.91	—1.83	33	.44 14	6		22.95	17.91	—5.04	78	33.04	Woolstaston
2.32	.95	—1.37	41	.24 14	5		17.73	14.82	—2.91	84	24.50	Bromsgrove
2.30	.87	—1.43	38	.35 14	9		16.75	14.43	—2.32	86	23.30	Boston
2.18	.97	—1.21	45	.32 14	6		17.81	13.17	—4.64	74	24.70	Hodsock Priory
2.32	.96	—1.36	41	.37 14	6		18.85	14.08	—4.77	75	26.18	Derby
4.38	2.30	—2.08	53	.54 14	10		29.61	33.54	+3.93	113	42.43	Bolton
2.53	.58	—1.95	23	.20 14	7		19.36	16.94	—2.42	87	26.96	Ribston Hall
5.13	1.84	—3.29	36	.73 5	9		42.00	44.00	+2.00	105	60.96	Arncliffe Vic.
2.40	.73	—1.67	30	.43 14	9		18.95	14.83	—4.12	78	27.02	Hull
2.36	.58	—1.78	25	.28 13	8		19.76	18.38	—1.38	93	27.99	Newcastle
2.76	4.39	—8.37	35	1.51 5	10		90.72	89.19	—1.53	98	132.68	Seathwaite
4.08	1.20	—2.88	29	.56 14	9		29.31	29.22	— .09	100	42.81	Cardiff
4.21	1.29	—2.92	31	.53 15	5		31.62	32.54	+ .92	103	47.88	Haverfordwest
4.20	1.55	—2.65	37	.65 13	9		30.66	32.51	+1.85	106	45.41	Gogerddan
2.92	.71	—2.21	24	.21 11	9		20.57	21.39	+ .82	104	30.98	Llandudno
3.71	1.08	—2.63	29	.29 13	6		29.86	32.25	+2.39	108	43.43	Cargen
2.77	.59	—2.18	21	.20 14	7		23.33	23.09	— .24	99	33.04	Riddell House
...	.55	...	...	.13 14	8		...	20.35	...	...	...	Edinburgh
4.08	1.26	—2.82	31	.38 11	9		30.19	26.12	—4.07	87	44.85	Colmonell
3.34	1.41	—1.93	42	.44 11	9		25.43	26.94	+1.51	106	35.80	Glasgow
5.53	4.87	— .66	88	1.67 11	11		39.64	45.51	+5.87	115	57.90	Tighnabruaich
5.47	4.44	—1.03	81	.86 5	11		38.53	35.27	—3.26	92	57.53	Quinish
2.55	1.05	—1.50	41	.25 11, 13	11		20.75	17.45	—3.29	84	28.95	Dundee
3.27	1.50	—1.77	46	...	...		24.93	22.98	—1.95	92	36.07	Braemar
3.04	.85	—2.19	28	.25 13	11		22.97	20.90	—2.07	91	33.01	Aberdeen
3.01	1.38	—1.63	46	.68 11	9		21.34	20.67	— .67	97	29.37	Cawdor
5.12	3.62	—1.50	71	1.80 5	8		37.81	38.77	+ .96	103	56.00	Invergarry
8.28	3.02	—5.26	36	2.20 5	7		57.69	62.68	+4.99	109	86.50	Bendamp
2.71	2.08	— .63	77	1.02 11	7		21.63	27.09	+5.46	125	31.60	Dunrobin Castle
...	2.43	...	...	.70 11	14		...	25.66	...	...	...	Castletown
4.67	1.09	—3.58	23	.21 12, 16	9		39.57	30.69	—8.88	78	58.11	Killarney
3.08	1.65	—1.43	54	.52 2	7		27.08	22.66	—4.42	84	39.30	Waterford
2.94	1.35	—1.59	46	.32 14	11		23.79	26.20	+2.41	110	33.47	Hurdlestown
2.80	.81	—1.99	29	.31 2	8		24.36	19.17	—5.19	79	34.44	Carlow
2.15	.70	—1.45	33	.20 11	7		19.68	16.12	—3.56	82	27.75	Dublin
3.17	...	...	...	...	...		26.36	...	...	...	37.04	Ballinasloe
6.72	3.31	—3.41	49	1.02 14	11		55.06	50.16	—4.90	91	80.23	Kylemore House
4.12	1.56	—2.56	38	.32 13	15		34.02	35.53	+1.51	104	50.50	Ennisce
3.37	.94	—2.43	28	.55 11	11		27.21	22.72	—4.49	83	38.61	Seaforde
3.77	1.49	—2.28	40	.43 14	12		28.25	30.46	+2.21	108	41.20	Londonderry
3.55	1.94	—1.61	55	.55 14	10		26.81	29.61	+2.78	110	37.85	Omagh

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	1·85	XI.	Rhayader, Tyrmynydd	1·42
„	Ramsgate, West Cliff Villas	1·85	„	Lake Vyrnwy	1·28
„	Hailsham	1·36	„	Llangyhanfal, Plas Draw	·80
„	Crowborough, Uckfield Lodge	1·90	„	Criccieth, Talarvor	1·14
„	Osborne, Newbarn Cottage	1·31	„	Llanberis, Pen-y-pass	3·20
„	Emsworth, Redlands	1·57	„	Lligwy	1·20
„	Alton, Ashdell	1·29	„	Douglas, Woodville	1·62
„	Newbury, Welford Park	1·05	XII.	Stoneykirk, Ardwell House	1·19
III.	Harrow Weald, Hill House	1·34	„	Dalry, The Old Garroch	1·50
„	Oxford, Magdalen College	·85	„	Langholm, Drove Road	1·44
„	Bloxham Grove	·99	„	Moniaive, Maxwellton House	·88
„	Pitaford, Sedgebrook	·91	XIII.	N. Esk Reservoir [Penicuik]	1·20
„	Huntingdon, Brampton	1·02	XIV.	Maybole, Knockdon Farm	1·44
„	Wisbech, Bank House	·90	XV.	Campbeltown, Witchburn	2·29
IV.	Southend Water Works	1·69	„	Inveraray, Newtown	5·22
„	Colchester, Lexden	1·57	„	Ballachulish House	6·28
„	Newport, The Vicarage	1·22	„	Islay, Eallabus	2·29
„	Rendlesham	1·43	XVI.	Dollar Academy	2·77
„	Swaffham	1·31	„	Loch Leven Sluice	1·35
„	Blakeney	·94	„	Balquhider, Stronvar	...
V.	Bishops Cannings	1·24	„	Perth, Pitcullen House	1·42
„	Ashburton, Druid House	1·09	„	Coupar Angus Station	1·20
„	Okehampton, Oaklands	1·35	„	Blair Atholl	1·79
„	Hartland Abbey	1·11	„	Montrose, Sunnyside Asylum	1·12
„	Lynmouth, Rock House	1·36	XVII.	Alford, Lynturk Manse	1·59
„	Probus, Lamellyn	·84	„	Keith Station	1·67
„	Wellington, The Avenue	·62	XVIII.	N. Uist, Lochmaddy	2·97
„	North Cadbury Rectory	1·04	„	Alvey Manse	1·83
VI.	Clifton, Pembroke Road	·82	„	Loch Ness, Drumnadrochit	1·36
„	Moreton-in-Marsh, Longboro'	1·23	„	Glencarron Lodge	5·30
„	Ross, The Graig	·68	„	Fearn, Lower Pitkerrie	1·51
„	Shifnal, Hatton Grange	1·21	XIX.	Invershin	1·43
„	Cheadle, The Heath House	1·65	„	Altnaharra	2·17
„	Coventry, Kingwood	·97	„	Bettyhill	1·97
VII.	Market Overton	1·25	„	Watten Station	1·93
„	Market Rasen	1·00	XX.	Dunmanway, The Rectory	·95
„	Bawtry, Hesley Hall	·87	„	Cork	·84
VIII.	Neaton, Hinderton	1·23	„	Darrynane Abbey	1·62
„	Southport, Hesket Park	1·68	„	Glenam [Clonmel]	1·65
„	Chatburn, Middlewood	1·30	„	Ballingarry, Gurteen	1·47
„	Cartmel, Flookburgh	1·71	„	Milltown Malbay	1·87
IX.	Langsett Moor, Up. Midhope	1·16	XXI.	Gorey, Courtown House	·82
„	Scarborough, Scalby	1·07	„	Moynalty, Westland	1·32
„	Ingleby Greenhow	·67	„	Athlone, Twyford	1·28
„	Mickleton	·52	„	Mullingar, Belvedere	1·44
X.	Bardon Mill, Beltingham	1·10	XXII.	Woodlawn	1·64
„	Ewesley, Fallowlees	·90	„	Westport, Murriak Abbey	1·70
„	Ilderton, Lilburn Cottage	·38	„	Collooney, Markree Obay	2·09
„	Keewick, York Bank	1·56	XXIII.	Enniskillen, Portora	2·10
XI.	Llanfrechfa Grange	1·22	„	Warrenpoint, Summer Hill	·67
„	Treherbert, Tyn-y-waun	2·80	„	Banbridge, Milltown	·94
„	Carmarthen, The Friary	1·31	„	Belfast, Springfield	1·45
„	Castle Malgwyn [Llechryd]	·95	„	Bushmills, Dundarave	1·74
„	Plynlimon	3·70	„	Stewartstown, The Square	1·43
„	Tall-y-llyn	1·00	„	Killybegs	3·27
„	New Radnor, Ednol	1·19	„	Horn Head	1·98

METEOROLOGICAL NOTES ON SEPTEMBER, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Opening with a burst of extraordinarily high temp., during which the shade max. twice exceeded the previous record during September, the month's weather continued on the whole fine and warm. The third week was more broken and rainy, but subsequently anti-cyclonic conditions again prevailed, with lower temp. Duration of sunshine 154.1* hours, and R 21.4 hours. Mean temp. 59°·8, or 2°·1 above the average.

CROWBOROUGH.—The first two days were exceedingly warm, the max. temp., 90°·9, on 2nd, being the highest since July 15th, 1881. The month on the whole was pleasant, with considerable brilliant sunshine. Mean temp. 58°·7.

HARTLEY WINTNEY.—Another beautiful month, very hot and dry for the first fortnight. Slight showers in the third week and cooler in the fourth, with E. winds and slight fogs. The great drought still continues with severity.

TORQUAY.—Duration of sunshine 229.0* hours, or 65.1 hours above the average. Mean temp. 60°·4, or 2°·2 above the average. Mean ozone 4.3.

CLIFTON.—Very fine with a large amount of sunshine, and only 5 rain days. The first 10 days were very hot, but from 18th the temp. was moderate, with cool nights and N. and N.E. anti-cyclonic winds.

ROSS.—The three months July, August and September produced only 2.09 in. of R, or 1.78 in. less than the previous smallest amount since 1818.

BOLTON.—Very sunny and dry, most of the R recorded falling during the night. The 2nd, when the mean temp. was 75°·2, was the hottest day ever recorded in Bolton. Duration of sunshine 110.7* hours, or 22.1 hours above the average. Mean temp. 55°·2, or 1°·2 above the average.

SOUTHPORT.—The sunniest September in 16 years, and the least cloudy in 36 years. Mean temp. 57°·0, or 1°·1 above the average, both the daily and monthly range being very great. Duration of sunshine 188.2* hours, or 45.8 hours above the average of 15 years. Duration of R 20.5 hours.

HAVERFORDWEST.—Fine and dry, with bright, warm weather throughout and small R. Duration of sunshine 222.0 hours. Crops good except potatoes.

DOUGLAS.—A beautiful month on the whole, perhaps the finest since these observations began. A week of not unwelcome R, though somewhat cold and stormy, till 18th, was succeeded by brilliantly fine, calm and warm weather. Gardens were superb and harvest well gathered.

DUMFRIES.—Exceptionally dry, the R having been less in 1894 and 1895 only during 47 years. The temp. was also very high being seldom exceeded during the same period. Harvest good, but potato disease was prevalent.

LILLIESLEAF.—R and number of rain days unprecedentedly small. There was most lovely weather for harvest.

CASTLETOWN.—The first two days were very warm, then damp and changeable to 15th. From 15th to the end was dry and sunny, with steady high bar. and light southerly winds. Corn cutting was general after 18th.

MILTOWN MALBAY.—Most of the month was fine, warm and sunny, making amends for the two previous months. Most of the harvest was well secured.

DUBLIN.—A fine, quiet and warm month, with unusual heat at the beginning. A remarkably persistent anti-cyclone from 16th to the 30th coincided with a rainless spell of 14 days, with cold and foggy nights. Mean temp. 57°·1, or 1°·2 above the average. Aurora borealis on the night of 22nd.

BELFAST.—The driest September since 1895, but foggy weather was prevalent especially in the latter days. Crops doing exceedingly well.

OMAGH.—For the first fortnight there was considerable R, thereby endangering the cereal harvest, but from 15th to 30th none whatever fell. It is long indeed since such a continuous and brilliant spell of settled weather occurred and a harvest was gathered under such perfect conditions.

* Campbell-Stokes.

Climatological Table for the British Empire, April, 1906.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	Inches		
London, Camden Square	73·0	12	30·1	15b	58·4	36·8	38·5	73	113·8	21·9	·51	9	...
Malta.....	79·0	16	47·0	1	65·7	53·6	51·6	78	...	44·0	·56	6	4·7
Lagos.....	93·0	3	72·0	20c	88·3	77·9	74·6	71	144·0	62·0	4·00	14	6·1
Cape Town ...	87·8	29	46·0	7	71·2	54·1	53·3	72	...	...	2·02	7	3·4
Durban, Natal	84·0	16	54·0	7	78·3	61·9	...	...	143·3	...	3·66	14	4·0
Johannesburg	78·4	14	37·0	7	68·6	50·2	44·7	64	143·8	33·8	·83	6	1·7
Mauritius.....	87·9	10	61·5	15	83·5	68·6	66·7	75	151·0	51·3	·16	4	5·9
Calcutta.....	104·9	11	71·4	3	97·5	77·3	72·0	65	168·0	67·4	·03	1	5·3
Bombay.....	91·5	27	72·3	3	88·0	75·5	72·8	76	136·2	64·9	·00	0	0·5
Madras.....	101·5	20	71·8	12	94·8	78·1	76·4	78	144·5	67·5	·00	0	1·9
Kodaikanal.....	77·3	17	50·8	1	73·8	54·8	46·5	55	145·0	30·9	2·73	6	3·4
Colombo, Ceylon.....	92·5	21	74·8	3	90·4	78·2	74·9	77	153·8	72·5	6·72	14	4·4
Hongkong.....	81·1	9	60·2	1	72·5	66·1	65·6	88	132·2	...	9·79	19	8·9
Melbourne.....	84·2	9	40·3	20	68·5	52·8	48·4	67	137·0	33·0	1·36	8	7·2
Adelaide.....	87·0	9	49·7	1	72·8	56·3	51·8	68	143·3	41·8	·88	12	6·3
Coolgardie.....	101·0	7	39·8	22	81·9	54·3	44·7	43	160·0	32·2	·00	0	2·6
Sydney.....	88·0	18	51·9	25	75·8	59·6	51·9	64	121·7	41·1	·93	14	4·3
Wellington.....	65·2	7	39·0	3	59·8	49·9	46·6	73	115·0	35·0	2·54	13	4·7
Auckland.....	71·0	1	45·5	22	65·1	52·7	52·3	81	130·0	42·0	3·10	17	5·5
Jamaica, Negril Point..	86·2	9, 13	63·9	6	84·5	70·0	69·1	72	...	...	6·45	10	...
Trinidad.....	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada.....	87·8	13a	71·0	4	85·7	74·4	68·1	67	149·6	...	·46	8	3·2
Toronto.....	69·2	18	27·3	7	52·2	35·8	33·8	69	91·5	18·0	1·61	9	4·9
Fredericton ...	62·7	30	10·2	3	48·4	27·3	24·0	54	...	...	3·56	11	5·6
Winnipeg.....	80·8	25	17·5	4	60·3	33·7	...	...	...	...	1·64	5	4·7
Victoria, B.C.....	70·7	29	32·6	13	59·8	42·1	...	...	...	...	·46	10	5·3
Dawson.....	...	...	...	...	...	...	...	...	...	...	...	...	...

a and 17. b and 20, 26. c and 30.

MALTA.—Mean temp. of air 58°·5, or 1°·1 below the average. Mean hourly velocity of wind 10·2 miles, or 1·0 below average. Mean temp. of sea 62°·1.

MAURITIUS.—Mean temp. of air 0°·2 above, dew point 2°·1, and E 4·80 in. below averages. Mean hourly velocity of wind 8·6 miles, or 1·9 below average.

MADRAS.—Bright sunshine 239·7 hours.

KODAIKANAL.—Bright sunshine 233 hours.

COLOMBO.—Mean temp. of air 84°·3, or 1°·7 above, of dew point 0°·4 above, and E 4·06 in. below, averages. Mean hourly velocity of wind 7·0 miles.

HONGKONG.—Mean temp. of air 69°·0. Bright sunshine 53·3 hours or 55·8 below the average, mean hourly velocity of wind 17·4 miles, and E 4·23 in. above averages.

ADELAIDE.—E 99 in. below average.

SYDNEY.—Mean temp. of air 3°·0 above, and E 4·61 in. below, averages.

WELLINGTON.—Mean temp. of air 2°·1 below, and E 1·28 in. below, averages.

AUCKLAND.—Mean temp. of air and E very close to average of previous 38 years.

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VOL. XLI.

THE CLIMATOLOGICAL ATLAS OF INDIA.

WE welcome the largest and most elaborate contribution to the Climatology of the British Empire in the splendid Atlas* by Sir John Eliot, which has just been published.

Volumes 13 and 14 of the *Indian Meteorological Memoirs* gave a summary of the instrumental observations made in India down to 1900, and the data there published in figures are now presented in the more expressive form of maps. Consistency is hard to attain in any large undertaking, and perhaps hardest of all in dealing with observations of the various elements of climate in all parts of a great tropical country, where most of the observers are natives, to whose minds the scientific method is not the most congenial. The Indian Meteorological Service has passed through three stages of evolution, the first prior to 1865, during which such records as existed were the result of local and often spasmodic effort, the second down to 1875, when the importance of the records was realised, and their organization taken in hand by the provincial governments, under different directors, pursuing different methods; and the third since 1875, when the whole system of observations in India was placed under the control of the Imperial Indian Government, and the entire direction confided to one eminent meteorologist. Thus by the close of the nineteenth century there was available for discussion a great amount of meteorological observations, extending over 25 years, obtained under uniform conditions by fairly trained and competently inspected observers. This is the mass of material which is now before us elaborated into 120 plates of beautifully executed coloured maps, and forming a unique storehouse of the climatology of a great unit of tropical land.

The maps are accompanied by a brief explanatory text, which

* *Climatological Atlas of India*. Published by the authority of the Government of India, under the direction of SIR JOHN ELIOT, K.C.I.E., F.R.S., late Meteorological Reporter to the Government of India and Director-General of Indian Observatories. Issued by the Indian Meteorological Department, 1906. (Copies of this work may be procured through Messrs. John Bartholomew and Co., The Geographical Institute, Edinburgh. Price, per copy, 27 rupees in India, and 36 shillings in the United Kingdom). Size 18 × 12½. Pp. xxxii. + 120 plates.

adds to their value, and whets the anticipations of the Handbook of the Meteorology of India, which is being compiled as a companion work to the Atlas. There is a mechanical difficulty about the letterpress of this Atlas, which affects the short-sighted reader most unpleasantly: the lines are ten inches long, and in travelling back after following one line to the end, the eye is apt to fall upon the wrong line for the next beginning. Double column printing would have saved a good deal of strain and fatigue to many students.

The first plate in the Atlas is a double page orographical map of India, which brings vividly before the eye the physical contrasts of the country—the low Indo-Gangetic plain in the north, with the huge wall of the Himalaya and the vast plateaus of Tibet and Afghanistan beyond on the northern side, and the moderate elevations of the Deccan filling the peninsula on the southern; and on the east beyond the Bay of Bengal the parallel ranges of south-running mountains in Burma. The main contour lines indicating these all-important features form an unobtrusive background on the maps of meteorological conditions which follow. Then comes a double page map showing the complicated political divisions of India, distinguishing States which remain under native rulers, and thus helping to make clear one of the chief difficulties in securing a uniform system of meteorological observations over a territory which is larger than all Europe outside Russia, and contains more separate units of government. A set of four smaller maps show the rainfall divisions adopted by Mr. Blanford and Sir John Eliot respectively, the medical provinces and the divisions used in the Indian Daily Weather Report.

Pressure and winds are shown in two double page charts of the whole Indian Ocean area for the extreme months January and July. The authority for the winds over the Indian Ocean is not stated, but they are obviously the result of observations and not deduced from the isobars, for in some instances they blow in opposition to the barometric gradients shown; the general scheme of circulation is however perfectly clear, the air flowing from India towards Africa and Australia in January, and towards India from Africa and Australia in July.

The remaining maps refer to the Indian Empire alone. They deal with the various meteorological elements with a degree of detail never hitherto attempted. For pressure and wind there are first of all thirteen plates, giving for each month and for the year the conditions prevailing at 8 a.m., and on a smaller scale at 10 a.m. and 4 p.m. The two latter are particularly interesting, for they show the space as well as the time relations of the great and regular diurnal range of pressure in the tropics, (in some parts of India 1.70 in. on the average of a month) and in many places we observe the pressure gradients and wind-directions reversed between forenoon and afternoon. In the annual map for instance at 10 a.m. the isobar of 29.800 inches only occupies a small area on the Indus,

and pressures exceeding 29·875 occur in the south-west, while at 4 p.m. the whole of India is subject to a lower pressure than 29·800, and in the north-west it is below 29·675. A second series of thirteen plates gives for each month and the year the mean pressure for the day, and the diurnal range expressed in two ways, first as actually observed, and second as calculated from the readings reduced to sea level. From the uncertainty of reducing the barometer readings of very lofty stations, none above 3000 feet are utilized, the maps only going as far to the north as Peshawar, Simla, and Darjeeling.

Thirteen plates are next devoted to mean temperatures, dealing with the mean of the day, the mean maximum, and the mean minimum for each month and the year, the data being calculated on a 20 years' average, and reduced to sea level by applying the correction of 1° for every 450 feet of elevation (instead of 1° for 300 feet usually adopted for temperature maps of the world). The average temperature of India being 80° , the colouring of all the maps is so adjusted that temperatures above 80° are indicated in red; below it in green. Mean maximum temperatures of over 100° appear in March, and the area they affect is greatest in May when they prevail over the greater part of India, and they appear for the last time in September.

Another set of thirteen plates is devoted to temperature, showing the diurnal range, the absolute maximum and the absolute minimum for each month and the year. Such data as the two last, which depend on various conditions, cannot be expected to yield perfect results when expressed by lines of equal values, but they are graphic representations all the same. The highest extremes occur in the Indus valley, where minima of 25° or less are recorded near Peshawar in December and January, and maxima of 125° and more about Jacobabad, half-way between Peshawar and the sea, in June and July. The greatest diurnal range (averaging 35° over a month) occurs in September, October and November in the same region of the North-west.

The series of 26 plates devoted to humidity include maps for each month and for the year of the mean relative humidity, and of the mean absolute humidity, expressed as vapour pressure; in each case the daily mean, 8 a.m. mean and 4 p.m. mean for the month being given. These are novel maps full of interesting features. The most striking contrasts are exhibited in the maps for 8 a.m., which show relative humidities of over 90 per cent. for almost every month in Eastern Bengal and Assam, while on the opposite side of India the relative humidity varies with the season from 50 per cent. to less than 30 per cent. There is naturally a much greater diurnal variation of relative than of absolute humidity on account of the great diurnal range of temperature.

A beautiful series of cloud maps for the day and for 8 a.m. and 4 p.m. is another novel feature, and the system of colouring from clear blue for less than one-tenth of the sky clouded to a dark

neutral tint for more than seven-tenths is extremely effective. It is surprising to find that an observation so much affected by the personal equation as is the estimation of cloudiness by eye, yields such satisfactory maps; the general map for the year exhibits a steady diminution of cloudiness from south-east to north-west.

Two sets of maps are devoted to rainfall, the first giving for each month and for the year what is termed the normal rainfall, with the number of days on which the rainfall exceeded $\cdot 10$ in., and the storm tracks; the second giving the seasonal rainfall and the number of rain days, together with maps of the computed atmospheric pressure at 10,000 feet.

We could wish for more practical details as to the data and methods in the introductory text; it would not have taken much more space to give a general statement as to, *e.g.*, the exposure of thermometers, the height of rain-gauges, the exact period used for calculating averages, and in cases where the averages of different periods at different stations are included a short statement of the probable differences in amount between the averages for the various periods. No doubt all these particulars may be gleaned from the Indian Memoirs, but the Atlas is bound to come into the hands of many who have not access to those volumes. In the case of the rainfall maps, which are based on the records of some 2000 stations, all of which cannot have been in operation during the whole period, the want of information as to the precise conditions implied by the word "normal" is particularly felt, and if it had been possible to give a map showing by dots the distribution of all the stations utilized, it would have been very helpful in the effort to deduce from the maps the exact relation of rainfall to configuration and prevailing winds, the general trend of which is very distinctly shown.

The Atlas taken in conjunction with the Memoirs published already, and the Manual that is to follow, will give the completest account of the climatology of a large country which we possess, and apart from any other publication the Atlas alone is a magnificent acquisition, a very mine of meteorological relationships, for which we cannot be too grateful to the enlightenment of the Indian Government, the patient labour of Sir John Eliot and his assistants, and the technical perfection of the Edinburgh Geographical Institute.

A PLEA FOR THE TEACHING OF METEOROLOGY.

By R. H. CURTIS.

THE growth of an intelligent interest in meteorology on the part of the general public is manifesting itself in several ways. One very unmistakable sign of it, which everyone may note, is to be found in the amount of attention which is now paid to the subject of the weather by the daily press, and particularly to the forecasts of the weather published every morning. Not so very long ago there were comparatively few people who troubled themselves to look at these forecasts at all, and the majority of those who did do so regarded

them as little more than guesses,—generally good guesses, perhaps, because they were understood to have been made by people who had given more than ordinary attention to the subject, and presumably had by dint of long practice acquired more skill in reading the signs of coming changes in the weather than ordinary folk possessed ; but they were rated as guesses nevertheless, with no more really scientific basis than existed for the predictions of “Old Moore.” But to-day the change is great. The forecast is the first thing looked at by thousands of men and women when they open their morning paper at breakfast, or in the train, or on their way to business ; and these forecasts are treated with respect as being scientific deductions from observed conditions of the atmosphere, considered in relation to the laws, as far as they are known, by which the movements of the atmosphere are governed. That is the gist of the reply which probably the majority of those who study the forecasts would make if asked to give their opinion about them, although, likely enough, very few could go a step further and give even the most elementary account of the laws themselves. It is, however, a step in advance that the public mind is beginning to accept the fact that there are any “laws” at all in the matter, and to recognize that the daily sequence of weather is not simply fortuitous,—the result of the purest chance. When so much is admitted, a desire on the part of many to get some sort of acquaintance with the laws is sure to follow, and the day when all ordinarily well-educated people will possess at least some elementary ideas of a sound nature about meteorology will thereby be brought considerably nearer.

But signs of the spread of this spirit of enquiry are not wanting even now, and its progress would seem to be more real than possibly many meteorologists suppose. Indeed it may not be amiss to express the hope that some meteorologists may themselves be stirred to acquire a better knowledge of the theoretical side of the subject than they already possess, for it is not an unknown experience to meet with men who make daily observations of the barometer and of temperature, who have a rain gauge, and know all about the rainfall of the district in which they live, and who locally have the reputation of being “meteorologists,” but who nevertheless would be sorely puzzled if asked to describe a typical “depression,” or to explain what is known as “Buys Ballot’s law.”

Anyone passing the Meteorological Office in Victoria Street might see at almost any time in the day people stopping at the door, not merely to scan the forecasts exhibited there, but also to study the charts hung by their side, upon which the forecasts are based. Not infrequently when friends are examining these charts together, an interesting discussion, or perhaps explanation, may be heard regarding the relation of the forecast to the conditions indicated by the chart ; it is not always that these explanations proceed upon orthodox lines, although frequently they do, but be that as it may they show that the broad principles of the subject are receiving

some attention, and to that extent they are welcome indications of progress to all who are interested in the furtherance of the study of meteorology.

Another and still more promising indication of progress may also be noticed at the door of the Meteorological Office, at a particular part of the day, when the students from a neighbouring training college for schoolmasters going for, or returning from, their daily walk, gather in small groups round the charts, discussing the sequence of changes shown during the past few days, and sketching in their note books the present distribution of pressure and of temperature, and the wind circulation, with a view to subsequent class lectures on the subject. In the direction which this fact indicates lies, we think, the great hope of popularizing the science of meteorology. Hitherto it has been almost entirely omitted from the curricula of our schools, and from the training of the teachers. Smatterings of it have found their way into that olla-podrida of the sciences which under the name of "physiography" has for years been a favourite subject with school teachers in the annual South Kensington Science examinations; but since in addition to meteorology the paper in this subject usually embraces questions in astronomy, geology, vulcanology, chemistry, and possibly other branches of science as well, it is obvious that the modicum of knowledge of each which a student who aspired to grapple with such a "general knowledge" paper would probably acquire, would be insufficient to enable him to teach any of them.

But why should not meteorology now be regarded as a science sufficiently mature to be able to stand upon its own feet, and why should not school teachers be encouraged to take a course of study in meteorology as complete as is now usual in the case of botany or of physiology? Teachers would then have a real acquaintance with the subject, and would be able to impart their knowledge satisfactorily to their pupils; and without doubt both teachers and taught would find the subject at once interesting and useful.

There are teachers who have already made this discovery and have profited by it. Of course in some schools, such as those for young seamen, or those for students of agriculture, meteorology naturally secures a prominent place; but in some "public elementary" schools the subject is also taught so far as first principles are concerned, and the interest of the pupils is further secured by getting them to observe instruments which have been provided as part of the school equipment.

In this country we, as a rule, move slowly, and although the inclusion of meteorology in the ordinary curriculum of school instruction has been advocated for many years, very little has yet been done to bring it about. But the growth of general interest in the subject to which we have drawn attention should we think aid materially in its accomplishment, and with the further development of that interest the time when meteorology shall form a common subject in schools of all grades should not be very distant.

THE RAINFALL OF OCTOBER AND OF 1906.

OCTOBER is normally the wettest month in the year over the greater part of the British Isles, and the month recently ended has exceeded its reputation, for as the mean of 52 well distributed stations the general rainfall of the British Isles has exceeded the average by 42 per cent. The value given for Londonderry in the Table is not supported by other stations, and it seems possible that a mistake has been made in copying the record. Assuming that this is so, the only place where the rainfall of October fell below the average was the extreme north-east of Scotland, where the month was comparatively dry at the stations in Sutherland and Caithness. The excess in the West Highlands was slight, and there were patches in the Lake District, in Wales, Cornwall and Devon, and round the Thames estuary, where the excess did not exceed 25 per cent. London, with only 11 per cent. excess, was one of the driest parts of the country, but the higher land of the Thames valley was nearly the wettest, the rainfall in parts showing an excess of more than 66 per cent. The wettest part of the country, except for a solitary high reading at Aberdeen, was the belt from the Humber to the Severn, where for so many months there has been the greatest drought.

During October there was an exceptionally large number of wet days, but none of excessive wide-spread wetness. Falls of an inch or more in 24 hours occurred only at 25 stations of the 52 under consideration, and at these they were experienced in the track of one or other of the numerous depressions which crossed the country, over 1 inch being measured on the 1st, 2nd, 11th, 18th, 19th, 25th, 26th, 27th, 28th and 30th. The month may thus be classed as generally wet, by whatever standard one cares to employ.

The result of this wet month on the average rainfall of so much of the year as has passed is to wipe out the deficiency of rainfall produced by the dry summer, and up to October 31st the rainfall of the British Isles as a whole was exactly equal to the average. There was very little variation throughout the country, the only large area still uncompensated for the summer drought being the east, south-east, and centre of England, where the deficiencies ranged from 5 to 13 per cent. of the average. The extreme rainfall of the first fortnight of November has made it extremely probable that 1906 will have to be classed as a "wet year."

If the relationship between autumn rainfall and the following wheat harvest holds good the prospects for next year are not promising, but on the other hand the replenishment of springs and wells has been going on apace, and the storage of underground water—a subject on which we know far too little—should be satisfactorily advanced for the season.



Correspondence.

To the Editor of Symons's Meteorological Magazine.

PHOTOGRAPHIC SUNSHINE RECORDERS.

YOU ask for the opinions of your readers on the relative merits of the photographic and burning sunshine recorders. I have made a careful comparison of these instruments for many years, and my opinion is that the Meteorological Office should have condemned the ferroproussiate paper instead of the recorder. I am convinced that ferroproussiate paper is quite unsuitable. Besides the difficulty of making different batches equally sensitive, it is impossible to keep this sensitiveness for very many months. An observer, who has both recorders, recently showed no less than 200 hours too little sunshine in one year compared with the Campbell-Stokes, and when I asked him the reason, he said it was the paper.

After much experiment I determined that a special kind of collodio-chloride of silver paper was the most suitable, and this has



now been used for some years in my sunshine-recorders all over the world. Gelatino-chloride of silver is useless, as the damp sets up a mouldy growth in the gelatine which soon spoils the paper, but collodion is quite unaffected by damp. If, as you suggest, there is to be a fresh comparison of sunshine-recorders, I trust that this paper will be used. I have modified the aperture of the Jordan pattern recorder to suit this paper, and also to enable, if desired, the same strip of paper to be used for a week. This makes a very simple and inexpensive sunshine-recorder, and is much superior to the Campbell-Stokes. The latter instrument is good enough on a clear bright day with no passing clouds, but if any of your readers at mid-day in summer expose a chart for only 10 seconds they will find that the record measures nearly 10 minutes. Therefore, on days with much passing cloud the burns spread and run into each other, and

give a very erroneous record. This is well shown in the photograph. The Campbell-Stokes recorder at 6 a.m. on April 27th gave a correct record, the sun's rays at that early hour not being very hot, but later in the day the record is one of almost continuous sunshine, instead of being a typical April day—showers and sunshine. Some years ago when I pointed out this fault of the Campbell-Stokes to the Meteorological Office, I was told that *uniformity* was more essential than *accuracy*. I admit that uniformity is absolutely essential, but I totally fail to see why it must be *uniformity of error*.

A. LANDER.

Canterbury.

THE GREEN FLASH.

I READ with much pleasure Mr. Thurburn's very thoughtful contribution to this subject in your September issue (pp. 150-1). I have waited until your October number came out in the hope that some correspondent, more competent than myself, would have dealt with the matter. The points brought forward by Mr. Thurburn to account for the absence of the green flash when circumstances appear favourable deserve to be very carefully considered, and I think that they furnish at least a partial solution of the problem.

At every clear sunset the telescope shows us the sun's upper limb fringed with the more refrangible colours—the green and blue. Whether, when the sun's tip disappears, this effect of atmospheric dispersion will give rise to a green flash visible to the naked eye will depend (I think) upon three factors—the brightness, the extent, and the duration of the flash. The duration may be largely affected by the observer's latitude and the extent by the refractive condition of the air. Mr. Thurburn has well pointed out conditions that may affect the brightness.

I append a list of a few recent observations made this year. The letter O denotes an opera glass, power three; the letter B a binocular, power nine.

- (1.) *11th June*, 8 h. 25 m. p.m., Leeds, distant land horizon. Sun red. No flash seen. Used O.
- (2.) *8th July*, 8 h. 28 m. Locality as in (1). Sun deep yellow. No flash. Used O. Evening beautifully clear.
- (3.) *24th July*, 8 h. 0 m. Locality as in (1), but sun set behind a low bank of cloud with a slightly frizzy edge. No flash. Used B.
- (4.) *31st July*, 8 h. 0 m. Locality as in (1). A faint, but unmistakable green flash. Evening very clear. Used B. In the morning there had been a thunderstorm.
- (5.) *22nd August*, 7 h. 0 m. Pass of Llanberis. Land horizon, formed by a ridge of Snowdon. Perfectly clear. No flash. Used B.

It will be noticed that though aided by a glass, I saw the flash only once in these five attempts.

C. T. WHITMELL.

Invermay, Leeds, 18th October, 1906.

THE duration of the visionary image produced by looking at a bright coloured object depends on several conditions ; as, for example, the condition of the atmosphere, the condition and direction of the eye of the observer, the time the object is looked at, etc.

When the eye is in a condition of complete repose, and therefore susceptible, as in the evening twilight or on waking in the morning, it will, if a bright-coloured object is looked at for a moment, produce out of itself a visionary image of this object in the complementary colour. This visionary image will itself last only a second or so, and may well be described as a "flash."

The reason that the phenomenon is so seldom seen is probably due to the fact that special conditions are necessary for its production. The condition of the atmosphere must be suitable ; the physical and other features of the place where the sun is rising or setting, and of the district between the observer and the sun must be favourable. The eye of the observer must be susceptible, and it must be properly directed and so on.

It must be remembered that the rising or setting sun makes a notch in the horizon. This is probably the reason why the tips of the segment may appear red, changing to green in the complementary image, while the middle is white or yellowish. It may perhaps be seen better through a telescope, because the telescope brings the sun and the portion of sky near it closer to the observer.

One cannot expect everyone to think alike, and here is an example : The very same phenomenon, which I am convinced is physiological, some others consider to be physical and due to refraction.

I cannot believe that the phenomenon has ever been seen, unless the red edge or red colour or red ray of the rising or setting sun has been first seen above the horizon.

R. C. CANN LIPPINCOTT.

Over Court, Almondsbury, Bristol, 5th November, 1906.

AN AUDIBLE METEOR ?

BETWEEN half-past ten and a quarter to eleven on the night of August 7th last I was riding home on my bicycle, when I distinctly heard a faint but clear sound above my head like that made by a rocket as it passes through the air at a considerable distance. On

looking up I saw a shooting-star still on the move, but leaving a streak of light behind it. It is difficult to describe, but when I first looked up there was a streak of light which got increasingly longer from one end until after quite an appreciable time the moving end suddenly stopped. The streak seemed to remain still for a while, and then quite gradually ceased to exist, the light diminishing from both ends and then going out.

I should like to know whether you think the sound heard had anything to do with what I saw, as the combination of the two things struck me as being very odd. I may add that the night was a fine one and very still.

E. HUNTLEY.

Friars Street, Sudbury, Suffolk, September 13th, 1906.

FIREBALL.

On Sunday, 13th May, 1906, I was watching the heavy rain, hearing the rattling of the large hailstones and listening to the near and deafening noise of the rumbling thunder, when suddenly I thought "How strange, I have not seen one flash of lightning!" I leaned forward to have a wider range through the open window, when I saw a large, dark egg-shaped ball swiftly falling straight down from the sky in the open space between two elm trees on the lawn and a fir-tree. When the ball came to about the height of the latter, it suddenly collapsed and sparks of fire flew about in all directions like a magnificent firework. I was so startled that I fell back, but afterwards looked out to see if there was any impression made on the ground. I could see nothing, sheep, lambs, the cob and pony, were grazing, but not near the spot. Two miles away glass was broken and grass burned during the storm.

When the ball split, a solid lump of rather *light* looking fire (like the colour of a blaze) issued forth, at first more from the bottom than the sides, and this emitted thousands of red-hot (bright deep red) sparks which flew in all directions, taking a circular shape. It all happened in the wink of an eye. It seemed to my sight the size of a goose's egg, but my naturally long sight is defective from age. The servant describes it as "a large globe." She is near-sighted.

S. E. L. G.

East Woolsey, Morchard Bishop.

[There is a great deal of uncertainty in the records of all sudden appearances of short duration, and it does not follow that the impression produced on the eye by a sudden light corresponds to the real phenomenon. The above description, however, appears worthy of being placed on record.—ED., *S.M.M.*]

STORM CLOUDS ON NOVEMBER 3rd.

POSSIBLY readers may have studied the remarkable cloud forms which brought the heavy rain of November 3rd.

At Ide Hill, near Sevenoaks, the forenoon was mild and sunny, and the woodland foliage, having at length after several weeks succumbed to the chill embrace and waning light of autumn, was all aglow in shades of gold, orange, russet and carmine, with warm and gentle sunshine. But in accordance with the inclemency of late autumn, this fitful gleam of sunshine proved of short duration, and in less than three hours the air was becoming harsh and cold, whilst dark lowering cumulus clouds of bold and mountainous form, with patches of glaucous sky interspersed, were moving rapidly from the southward, causing the coloured landscape to assume an expression at once sombre, impressive and beautiful.

About 3 p.m. heavy rain, accompanied by occasional thunder and lightning of slight intensity, commenced to fall, and continued till late in the evening. I may add that as I was walking after dark in the heavy rainstorm from Ide Hill to Sevenoaks, pheasants in the woods were calling vehemently.

The electric potential gradient during the day over the south of England must have been very steep, and we may presume that but for the absence of a dry stratum of air between the thunderclouds and the ground, equilibrium would have restored itself by violent disruptive discharges, instead of by a nearly quiet flow of electricity along the moist conducting paths.

The weather chart for 8 a.m. on November 3rd shows a distribution of pressure favourable to thunderstorms.

L. C. W. BONACINA.

November 4th, 1906.

HEAVY RAINFALLS.

THE rainfall at Sunderland for the 24 hours ending at 8 a.m. on October 19th amounted to 2.13 inches. This is the second time this year that the amount for 24 hours exceeded 2 in. (see this Magazine, p. 92). The same occurred in 1900. From September 25th, 1888, inclusive, this is the eighth time a fall has exceeded 2 inches, but it is remarkable that between September 19th, 1859, when over 2 inches fell, and that date, there was no such fall.

T. W. BACKHOUSE.

West Hendon House, Sunderland, 22nd October, 1906.

RAINFALL TERMINOLOGY.

RE term for a rainy period. Why not use "Drench"? Is it not quite as appropriate as "Drought"?

CH. P. HOOKER.

Dollarward House, Cirencester.

THE RAINFALL OF BEIRA.

THE Companhia de Moçambique has forwarded to us the readings of rainfall taken at Beira, from August, 1901, to July, 1906. We quote below the four complete years of this record, which is remarkable for the extreme variability of the monthly values. It would appear that the five months from November to March constitute the wet season, the seven months from April to October being dry. The two parts of the year divided in this way give the following totals of rainfall.

	1901-2.	1902-3.	1903-4.	1904-5.	1905-6.	Average.
November to March..	46·30	25·23	55·27	43·12	31·77	40·34
April to October.....	6·77	12·52	17·68	3·68	No obs.	10·16

It is probable in view of the extreme variability which this table shows that if the record were longer it might be necessary to alter the limits of the wet and dry seasons. We are not informed whether this record was taken from the great rain gauge, a photograph of which was given in this Magazine, Vol. 40, p. 204, but presume that it was so.

*Rainfall at Beira, Portuguese East Africa, lat. 19°50' S., long. 34°50' E.
50 feet above the sea.*

	1902.	1903.	1904.	1905.
January	8·65	10·47	18·01	3·34
February	10·46	3·35	10·30	11·39
March	18·70	5·06	13·22	15·93
April	·59	2·76	8·74	·29
May	2·25	2·75	3·57	·61
June	·29	·29	·19	·20
July	·42	·10	1·31	·96
August	·41	5·11	·74	1·14
September.....	·51	1·00	·93	·48
October	2·30	·50	2·21	...
November	4·34	9·58	2·12	3·96
December	2·00	4·18	10·33	9·40
Total	50·92	45·15	71·67	47·70

METEOROLOGICAL NEWS.

LECTURES ON METEOROLOGICAL SUBJECTS, under the scheme of the Royal Meteorological Society, will be given by the Society's Lecturer, Mr. W. Marriott, on November 14th at the College, Eastbourne; on the 24th at St. Felix School, Southwold; on the 28th at Christ's College, Brecon, and on December 18th at the Literary and Scientific Institution, Highgate.

REVIEWS.

Studies on the Diurnal Periods in the Lower Strata of the Atmosphere.
(Reprints from the *Monthly Weather Review*, 1905.) By FRANK
HAGAR BIGELOW, M.A., L.H.D., Professor of Meteorology.
Washington, 1905. Size $11\frac{1}{2} \times 9\frac{1}{4}$. Pp. 52.

PROFESSOR BIGELOW here embodies the results of a discussion of data derived from balloon and kite ascents made at Berlin, Trappes, Hald and Blue Hill, during the past ten years, regarding the periodic diurnal variations occurring in those strata of the atmosphere lying between sea-level and an altitude of two miles, in temperature, pressure, vapour tension, electric potential, co-efficient of dissipation of electric charges, and action of the magnetic force. The periodic daily temperature variations occurring in the free atmosphere, which are different from, and often inverted with regard to, those at the surface, the diurnal, semi-diurnal, and tri-diurnal temperature waves, are held to explain the periodic daily pressure changes, the temperature waves affecting the density, and therefore the pressure of the air in the different strata, rather than evoking dynamic pressure waves as suggested by Lord Kelvin. The fact that the atoms and molecules of the atmospheric gases undergo partial "ionization" when exposed to certain conditions is brought forward to elucidate the problems of the diurnal periods of the terrestrial magnetic force and electric potential gradients. The free electric charges or "ions," the products of temporarily ruptured molecules of aqueous vapour or atoms of the elementary gases oxygen and nitrogen, by moving from one level to another, occasion the hourly variations of the magnetic field; by shifting from one hemisphere to another produce the daily variations of the field, auroral displays, Earth-currents, and by acting in conjunction with the diurnal temperature variations in the free air, originate the changes in the electric potential gradient.

The sun is to be regarded as a variable star. The variability in the intensity of solar activity as registered by the sun's spots, but more actively by its atmospheric hydrogen prominences, is shown from curves obtained by comparing the variations in solar activity with those in the activity of the Earth's magnetic field, and by computing the mean annual pressures and temperatures for the years 1872—1900, at several hundred stations scattered over the globe, to have a counterpart in the variability of the Earth's magnetic field and in changes of temperature and pressure in the Earth's atmosphere, through the electro-magnetic radiation of the sun; it is further demonstrated that while increased solar activity manifests itself directly in the tropical regions where the sun's rays are most powerful, by increased temperature, in temperate latitudes it is associated, or apt to be associated, with lowered temperature due to the augmented flow equator-wards of cold polar winds. The variations in the amount of solar energy received by the Earth, moreover, impose a complex modification on the circulation of the Earth's atmosphere, i.e., in the distribution of its pressure.

L.C.W.B.

The Rains of the Nile Basin in 1905, by CAPTAIN H. G. LYONS,
Director-General Survey Department. Cairo: 1906. Size 11 x 8.
Pp. 40. Maps and diagrams.

CAPTAIN LYONS has greatly extended the rainfall observations in the Egyptian Sudan, and correlated them with observations in Abyssinia, Eritrea, and British East Africa. In this report he points out that the rainfall over the Nile area is regulated by the sun's annual motion north and south of the equator, the region of heaviest precipitation shifting its position according to the time of year so as always to be approximately beneath the vertical sun, within the central low pressure system. Thus at the equinoxes the rainfall is heaviest in the equatorial lake regions, where the White Nile has its source, whilst in June, July and August, it is heaviest in northern Sudan and the Abyssinian tableland, in December and January the rains are south of the equator. That part of the Nile basin situated between 18° and 30° N. is practically rainless, but the delta which lies north of 30° N. comes within the influence of the Mediterranean winter rains. In 1905 the number of stations to afford rainfall measurements was seventy-eight, against forty-six in 1904, and the number of stations which merely record rain days was forty-four. The rainfall during 1905 was generally deficient over the Nile Basin. Over the delta the winter rainfall was fairly large as compared with that of 1904, the total depth at Alexandria during the six months January—March, and October—December, amounting to 10·6 inches; the importance of this winter rain is in connection with the barley crop. Over the Blue Nile plains the summer rains were abundant, but on the Abyssinian tableland, where, during the months of July and August the total amount of precipitation normally amounts to 27·5 inches, they were greatly deficient. The basins of the White Nile, Sobat and Bahr-el-Jebel, also experienced a great deficiency of rainfall.

The Nile flood* was only ·65 of an average flood, the average being based upon 163 years of reliable records. During the past ten years the value of the "flood" has slightly exceeded the average in 1896 and 1898, but has been below it in the other eight years. From the few existing records of the water-level of the Bahr-el-Jebel and of the rainfall over the basin of that river it has been found that the amount of rain which falls over a certain part of the basin has a special effect upon the water-level, and this fact should therefore be taken into consideration in the formulation of any project for increasing the volume of water which enters the White Nile.

Captain Lyons finds confirmation in 1905 of the relation between the rainfall of Abyssinia and the atmospheric pressure over north-eastern Africa, which he previously pointed out, viz.: that in years of scanty flood pressure is nearly always excessive, and *vice-versa*.

L. C. W. B.

* Reckoned upon the volume of water passing Aswan between July 1st and October 31st.

TEMPERATURE FOR OCTOBER, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				No. of Nights at or below 32°	
					Max.		Min.		Shade.	Grass.
					°	Date.	°	Date.		
Camden Square.....	London.....	51 32	0 8	111	71·0	1	35·4	26	0	0
Tenterden.....	Kent.....	51 4	0 41	190	72·0	11	34·0	15	0	4
West Dean.....	Hampshire.....	51 3	1 38	137	69·0	1	30·0	26	2	6
Hartley Wintney.....	.....	51 18	0 53	222	69·0	1, 17	30·0	26	1	6
Hitchin.....	Hertfordshire.....	51 57	0 17	238	69·0	9	33·0	26	0	...
Winslow (Addington).....	Buckinghamsh.	51 58	0 53	309	69·0	1	31·0	26	1	6
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	0 40	226	73·0	11	35·0	26	0	...
Brundall.....	Norfolk.....	52 37	*1 26	66	...	...	...	...	...	...
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	64·6	3	27·5	31	3	8
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	65·9	3	35·1	31	0	1
Polapit Tamar [Launceston].....	.....	50 40	4 22	315	64·6	3	31·2	20	1	5
Bath.....	Somerset.....	51 23	2 21	67	68·0	1	33·5	20	0	0
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	69·0	1	37·0	13	0	...
Church Stretton (Woolstaston).....	Shropshire.....	52 35	2 48	800	63·0	1	26·0	14	7	...
Bromsgrove (Stoke Reformatory).....	Worcestershire.....	52 19	2 4	225	66·0	3	27·0	19	3	...
Boston.....	Lincolnshire.....	52 58	0 1	25	66·0	11	33·0	20	0	...
Workshop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	68·9	10	32·9	26	0	9
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	70·0	1	34·0	19	0	...
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	65·0	1, 5	32·2	14	0	4
Wetherby (Ribston Hall).....	Yorkshire, W.R.	53 59	1 24	130	...	...	...	...	...	...
Arneliffe Vicarage.....	.....	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park).....	E.R.	53 45	0 20	6	71·0	10	35·0	29	0	6
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	63·7	11	28·5	14	2	...
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street).....	Pembroke.....	51 48	4 58	95	62·6	1	28·8	20	1	5
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	68·0	5	27·0	9	4	...
Llandudno.....	Carnarvon.....	53 20	3 50	72	66·0	1	35·0	30	0	...
Cargen [Dumfries].....	Kirkcudbright.....	55 2	3 37	80	63·0	10	28·0	14	3	...
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	64·0	2	26·0	28	5	11
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	64·1	5	31·5	30	2	3
Colmonell (Clachanton).....	Ayr.....	55 8	4 54	140	63·0	2, 3	25·0	29	2	...
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	63·0	7	26·0	14	2	15
Tighnabruach.....	Argyll.....	55 55	5 14	50	58·0	7	30·0	30	2	3
Mull (Quinish).....	.....	56 36	6 13	35	57·0	22	...	...	...	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	64·9	7	29·8	30	2	...
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford).....	.....	57 8	2 7	120	65·0	5, 6	25·0	29	6	...
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	64·0	7	28·0	30	3	...
Castletown.....	Caithness.....	58 35	3 23	100	63·0	7	23·0	30	5	5
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	69·5	2	32·5	19	0	...
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	65·0	8	28·0	20	4	...
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	64·0	7	30·0	18†	4	...
Carlow (Browne's Hill).....	Carlow.....	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	65·1	6	32·9	20	0	3
Ballinasloe.....	Galway.....	53 20	8 15	160	69·0	21	23·0	19, 20	12	...
Clifden (Kylemore House).....	.....	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe).....	Mayo.....	54·4	9 18	74	...	...	...	...	...	...
Seaforde.....	Down.....	54 19	5 50	180	61·0	1, 10	29·0	27	2	8
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	63·0	10	27·0	19	6	8

† and 19, 31.

RAINFALL FOR OCTOBER, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
Aver. 1870-99.	1906.	Diff. from Av. in.	% of Av.	Max. in 24 hours.	No. of Days		Aver. 1870-99.	1906.	Diff. from Aver. in.	% of Av.		
in.	in.	in.		in. Date.			in.	in.	in.		in.	
2.85	3.15	+ .30	111	.47 29	17		20.59	17.86	—2.73	87	25.16	Camden Square
3.60	4.52	+ .92	126	1.16 30	18		22.40	19.55	—2.85	87	28.36	Tenterden
3.53	5.81	+2.28	165	.89 18	25		23.94	24.00	+ .06	100	29.93	West Dean
3.08	5.11	+2.03	166	1.14 18	21		21.52	20.30	—1.22	94	27.10	Hartley Wintney
2.72	4.19	+1.47	154	.83 18	21		20.05	19.21	— .84	96	24.66	Hitchin
2.89	3.94	+1.05	136	.78 2	19		21.85	19.64	—2.21	90	26.75	Addington
2.66	4.52	+1.86	170	.94 29	17		20.78	20.82	+ .04	100	25.39	Westley
2.98	3.17	+ .19	106	1.01 2	18		20.56	21.98	+1.42	107	25.40	Brundall
4.33	6.86	+2.53	158	1.09 1	26		30.05	31.94	+1.89	106	39.00	Winterbourne Stptn
4.09	4.52	+ .43	111	.72 9	22		27.83	23.52	—4.31	84	35.00	Torquay
4.97	5.72	+ .75	115	.92 1	26		30.17	31.38	+1.21	104	38.85	Polapit Tamar
3.22	4.91	+1.69	152	.83 2	25		24.93	22.37	—2.56	90	30.75	Bath
3.10	5.35	+2.25	173	1.09 2	27		24.38	21.58	—2.80	89	29.85	Stroud
3.99	5.46	+1.47	137	.71 17	27		26.94	23.37	—3.57	87	33.04	Woolstaston
2.55	4.34	+1.79	170	.72 18	22		20.28	19.16	—1.12	94	24.50	Bromsgrove
2.62	4.13	+1.51	158	1.15 2	21		19.37	18.56	— .81	96	23.30	Boston
2.77	5.01	+2.24	181	.93 18	23		20.58	18.18	—2.40	88	24.70	Hodsock Priory
2.77	5.05	+2.28	182	.86 2	25		21.62	19.13	—2.49	88	26.18	Derby
4.72	7.36	+2.64	156	1.54 28	29		34.33	40.90	+6.57	119	42.43	Bolton
3.18	4.94	+1.76	155	.67 18	24		22.54	21.88	— .66	97	26.96	Ribston Hall
6.55	10.63	+4.08	162	1.66 28	29		48.55	54.63	+6.08	113	60.96	Arncliffe Vic.
3.26	5.04	+1.78	155	1.36 18	20		22.21	19.87	—2.34	89	27.02	Hull
2.94	4.65	+1.71	158	1.64 18	23		22.70	23.03	+ .33	101	27.99	Newcastle
13.35	15.87	+2.52	119	2.72 27	28		104.07	105.06	+ .99	101	132.68	Seathwaite
4.81	7.67	+2.86	159	1.70 1	27		34.12	36.89	+2.77	108	42.81	Cardiff
5.63	8.79	+3.16	156	1.57 2	28		37.25	41.33	+4.08	111	47.88	Haverfordwest
5.58	6.77	+1.19	121	.90 17	27		36.24	39.28	+3.04	108	45.41	Gogerddan
4.08	5.23	+1.15	128	.92 17	26		24.65	26.62	+1.97	108	30.98	Llandudno
4.39	5.54	+1.15	126	1.34 26	20		34.25	37.79	+3.54	110	43.43	Cargen
3.24	5.65	+2.41	174	.75 4	26		26.57	28.74	+2.17	108	33.04	Riddell House
...	6.11	...	...	1.44 19	23		...	26.46	...	...	...	Edinburgh
4.97	7.52	+2.55	151	1.62 11	23		35.16	33.64	—1.52	96	44.85	Colmonell
3.36	5.33	+1.97	159	.80 11, 26	26		28.79	32.27	+3.48	112	35.80	Glasgow
5.72	8.92	+3.20	156	1.74 26	25		45.36	54.43	+9.07	120	57.90	Tighnabruaich
6.09	7.47	+1.38	123	.75 29	28		44.62	42.74	—1.88	96	57.53	Quinish
2.71	3.75	+1.04	138	.85 11	23		23.46	21.20	—2.25	90	28.95	Dundee
4.05	5.34	+1.29	132	... ..	...		28.98	28.32	— .66	98	36.07	Braemar
3.18	6.23	+3.05	196	1.48 19	22		26.15	27.13	+ .98	104	33.01	Aberdeen
2.85	4.07	+1.22	143	1.95 19	20		24.19	24.74	+ .55	102	29.37	Cawdor
5.54	8.04	+2.50	145	.97 26	17		43.35	46.81	+3.46	108	56.00	Invergarry
9.98	10.52	+ .54	105	1.37 27	28		67.67	73.20	+5.53	108	86.50	Bendamp
3.32	2.44	— .88	73	1.05 19	12		24.95	29.53	+4.58	118	31.60	Dunrobin Castle
...	2.84	...	...	.59 19	25		...	28.50	...	...	...	Castletown
6.05	7.61	+1.56	126	.74 26	30		45.62	38.30	—7.32	84	58.11	Killarney
4.00	6.10	+2.10	152	1.11 11	29		31.08	28.76	—2.32	93	39.30	Waterford
3.12	5.43	+2.31	174	.67 11	26		26.91	31.63	+4.72	118	33.47	Hurdlestown
3.48	4.63	+1.15	133	.81 26	21		27.84	23.80	—4.04	85	34.44	Carlow
3.08	3.32	+ .24	108	.50 11	22		22.76	19.44	—3.32	85	27.75	Dublin
3.45	4.69	+1.24	136	.68 27	25		29.81	32.05	+2.24	108	37.04	Ballinasloe
7.93	9.46	+1.53	119	1.60 25	21		62.99	59.62	—3.37	95	80.23	Kylemore House
5.04	6.43	+1.39	128	1.46 27	25		39.06	41.96	+2.90	107	50.50	Ennisce
3.82	5.13	+1.31	134	.94 11	25		31.03	27.85	—3.18	90	38.61	Seaforde
4.45	3.39?	...	...	.41? 27	26		32.70	33.85?	...	...	41.20	Londonderry
3.72	5.65	+1.93	152	1.15 27	30		30.55	35.26	+4.71	115	37.85	Omagh

SUPPLEMENTARY RAINFALL, OCTOBER, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	5.06	XI.	Rhayader, Tyrmynydd	8.85
"	Ramsgate, West Cliff Villas	1.57	"	Lake Vyrnwy	7.76
"	Hailsham	4.97	"	Llangyhanfal, Plas Draw	5.97
"	Crowborough, Uckfield Lodge	5.86	"	Criccieth, Talarvor	5.97
"	Osborne, Newbarn Cottage	5.30	"	Llanberis, Pen-y-pass	13.04
"	Emsworth, Redlands	5.05	"	Lligwy	6.44
"	Alton, Ashdell	5.73	"	Douglas, Woodville	4.80
"	Newbury, Welford Park	5.48	XII.	Stoneykirk, Ardwell House	5.90
III.	Harrow Weald, Hill House	3.82	"	Dalry, The Old Garroch	8.80
"	Oxford, Magdalen College	3.92	"	Langholm, Drove Road	7.19
"	Bloxham Grove	4.89	"	Moniaive, Maxwellton House	8.22
"	Pitaford, Sedgebrook	4.13	XIII.	N. Esk Reservoir [Penicuik]	8.30
"	Huntingdon, Brampton	3.41	XIV.	Maybole, Knockdon Farm	5.80
"	Wisbech, Bank House	2.94	XV.	Campbeltown, Witchburn	7.04
IV.	Southend Water Works	3.82	"	Inveraray, Newtown	10.18
"	Colchester, Lexden	3.46	"	Ballachulish House	10.39
"	Newport, The Vicarage	3.76	"	Islay, Eallabus	5.74
"	Rendlesham	3.06	XVI.	Dollar Academy	6.73
"	Swaffham	4.58	"	Loch Leven Sluice	5.33
"	Blakeney	1.90	"	Balquhider, Stronvar	...
V.	Bishops Cannings	5.47	"	Perth, Pitcullen House	3.39
"	Ashburton, Druid House	8.20	"	Coupar Angus Station	3.46
"	Okehampton, Oaklands	6.19	"	Blair Atholl	5.52
"	Hartland Abbey	5.12	"	Montrose, Sunnyside Asylum	4.03
"	Lynmouth, Rock House	6.66	XVII.	Alford, Lynturk Manse	5.21
"	Probus, Lamellyn	5.11	"	Keith Station	4.76
"	Wellington, The Avenue	4.82	XVIII.	N. Uist, Lochmaddy	4.49
"	North Cadbury Rectory	4.47	"	Alvey Manse	4.98
VI.	Clifton, Pembroke Road	5.88	"	Loch Ness, Drumnadrochit	6.27
"	Moreton-in-Marsh, Longboro'	5.20	"	Glencarron Lodge	8.78
"	Ross, The Graig	4.19	"	Fearn, Lower Pitkerrie	2.55
"	Shifnal, Hatton Grange	4.74	XIX.	Invershin	2.72
"	Cheadle, The Heath House	5.57	"	Altnaharra	3.27
"	Coventry, Kingswood	5.00	"	Bettyhill	2.88
VII.	Market Overton	4.44	"	Watten Station	2.48
"	Market Rasen	4.36	XX.	Dunmanway, The Rectory	7.25
"	Bawtry, Hesley Hall	4.87	"	Cork	4.14
VIII.	Neston, Hinderton	4.35	"	Darrynane Abbey	6.25
"	Southport, Heskeith Park	5.62	"	Glenam [Clonmel]	6.22
"	Chatburn, Middlewood	6.85	"	Ballingarry, Gurteen	4.88
"	Cartmel, Flookburgh	6.42	"	Miltown Malbay	7.55
IX.	Langsett Moor, Up. Midhope	7.68	XXI.	Gorey, Courtown House	4.78
"	Scarborough, Scalby	4.85	"	Moynalty, Westland	5.02
"	Ingleby Greenhow	6.34	"	Athlone, Twyford	5.84
"	Mickleton	4.88	"	Mullingar, Belvedere	5.89
X.	Bardon Mill, Beltingham	4.87	XXII.	Woodlawn	6.80
"	Ewesley, Fallowlees	7.10	"	Westport, Murrisk Abbey	5.86
"	Ilderton, Lilburn Cottage	6.44	"	Collooney, Markree Obsy	4.78
"	Keswick, York Bank	8.07	XXIII.	Eniskillen, Portora	4.91
XI.	Llanfrechfa Grange	7.73	"	Warrenpoint, Summer Hill	4.00
"	Treherbert, Tyn-y-waun	13.35	"	Banbridge, Milltown	5.22
"	Carmarthen, The Friary	8.98	"	Belfast, Springfield	4.79
"	Castle Malgwyn [Llechryd]	8.84	"	Bushmills, Dundarave	3.70
"	Plynlimon	11.05	"	Stewartstown, The Square	4.64
"	Tall-y-llyn	4.80	"	Killybegs	6.51
"	New Radnor, Ednol	6.12	"	Horn Head	4.64

METEOROLOGICAL NOTES ON OCTOBER, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—A cloudy, damp and extremely mild month, with few very fine but few very wet days. The mean temp. $54^{\circ}2$ was $4^{\circ}4$ above the average, and the highest in October during 49 years, except $55^{\circ}3$ in 1861. Duration of sunshine 56.2^* hours, and of R 49.6 hours.

CROWBOROUGH.—A pleasant, genial and unusually warm month. The mean temp. was $52^{\circ}9$, or $8^{\circ}5$ above that of October, 1905. R 1.62 in. above the average of 35 years. Prevailing winds S. and W.

HARTLEY WINTNEY.—Storms of wind and much R, chiefly at night. The days were warm and beautiful, and absence of frost enabled oaks in the neighbourhood to retain their leaf. Ozone on 13 days; mean 3.2 .

WELLINGTON.—Almost persistently rainy, R being recorded on 26 days, with a total an inch above the average. It was generally very mild, with the exception of the last three days.

ROSS.—A month with frequent R, but sunny intervals. Mean temp. $3^{\circ}1$ above the average of 40 years, the mean max., $58^{\circ}3$, having been exceeded twice only since 1859. No sharp frost, and only slight damage done to tender plants.

WORKSOP, HODSOCK PRIORY.—Very mild; the wettest October since 1885, and the wettest month since December, 1901.

BOLTON.—The warmest October on record since 1886, the mean temp. being $49^{\circ}4$, or $2^{\circ}5$ above the average of 20 years. The duration of sunshine was only 31.7^* hours, or 25.7 hours below the average; 12 sunless days.

SOUTHPORT.—Exceptionally mild, wet and sunless, with a preponderance of S.E. and S. winds, and low bar. pressure. Mean temp. $51^{\circ}7$, or $2^{\circ}8$ above the average. Duration of sunshine 74.5^* hours, being 20.0 hours below the average, and duration of R 92.1 hours. Underground water was at a low level until the middle of the month, but subsequently rose considerably.

HAVERFORDWEST.—Wet and stormy, most of the R falling at night. Generally mild. Agricultural operations were well advanced. Duration of sunshine 97.7^* hours.

LILLIESLEAF.—Remarkable for the great quantity of R, more than making up for the shortage of September. The weather was mild and good for the garden and for turnips.

MULL.—A very wet month. Violent gales from S.W. on 17th and 26th, which subsided as suddenly as they rose, but otherwise calm.

COUFAR ANGUS.—The R was .89 in. above the average of 26 years, and the number of rain days was the greatest in that period. The mean temp., $47^{\circ}6$, had not been so high since 1886. Pasture was never more abundant so late in the season.

ALTNAHARRA.—Exceptionally favourable weather throughout, with keen frost at night towards the end. No R below the 1000 foot line, except a shower or two, and above 2000 feet it did not remain long at any time.

CASTLETOWN.—Generally fine and settled. One of the finest harvest times for many years, corn crops being practically all stacked by 25th. Strong gale from 3 to 7 p.m. on 19th, beginning and ending suddenly.

CORK. The mean temp. was normal, that of the first half being $52^{\circ}6$ and of the latter half $45^{\circ}4$. R .84 in. above the average. Prevailing winds S. and N.W.

DUBLIN.—Mild but rainy. Mean temp. $51^{\circ}2$, or $1^{\circ}8$ above the average, but from 17th to 20th and from 27th to the close, sharp cold snaps occurred.

BELFAST.—A really disappointing month, and of no value to the land. The R was almost an inch above the average.

OMAGH.—A saturating month, with R on every day but one, and occasionally very heavy. Temp. was most irregular, day and night being abnormally high and low in rapid succession.

* Campbell-Stokes.

Climatological Table for the British Empire, May, 1906.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
London, Camden Square	78·9	8	32·1	1	63·8	45·9	47·3	78	123·9	27·8	1·09	14	7·5
Malta.....	86·8	31	49·6	4	72·8	57·6	54·5	73	...	42·9	·36	4	3·1
Lagos.....	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town ...	75·1	9	44·8	27	65·1	52·9	50·9	72	...	...	3·65	10	5·2
Durban, Natal	83·7	5	50·8	31	76·1	59·0	...	...	136·3	...	1·76	9	2·7
Johannesburg	72·8	14	34·2	19	66·2	47·3	42·5	66	139·0	31·6	·11	2	1·1
Mauritius.....	84·0	5	57·4	13	79·2	66·8	64·2	76	149·4	47·6	3·92	20	7·1
Calcutta.....	103·8	2	70·6	10	97·3	78·9	76·1	73	162·1	68·2	3·96	6	3·1
Bombay.....	93·0	30	76·9	1	91·5	80·9	76·4	73	139·2	71·8	·00	0	3·0
Madras	111·5	27	77·2	6	100·8	83·0	76·5	71	149·6	74·6	·00	0	2·9
Kodaikanal	76·1	25	52·7	21	71·1	56·4	51·8	67	142·2	39·3	4·10	16	4·4
Colombo, Ceylon.....	89·2	sev.	72·0	20	87·9	78·4	76·4	84	153·6	70·4	6·96	25	7·0
Hongkong.....	89·4	21	66·7	2	80·6	73·2	71·8	86	147·8	...	11·58	16	7·9
Melbourne.....	69·1	9	37·5	22	60·7	48·3	47·8	80	125·5	30·5	1·77	11	7·3
Adelaide.....	82·3	10	46·0	25	68·0	52·0	50·8	74	138·0	38·7	2·12	12	5·9
Coolgardie	84·4	16	38·1	11	71·9	48·7	44·0	56	142·0	33·2	1·49	4	3·6
Sydney	79·9	6	48·0	31	67·1	54·0	50·6	78	110·6	37·0	7·32	26	5·2
Wellington	64·5	3	39·8	6	56·7	47·6	46·8	80	105·0	35·0	6·18	17	7·2
Auckland	66·0	3, 4	41·0	5	60·0	50·8	49·6	81	118·0	35·0	4·60	17	6·0
Jamaica, Negril Point..	88·5	8	69·3	2	85·6	73·6	73·6	79	...	...	7·85	12	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada.....	83·0	5, 11	72·2	23	85·6	75·0	70·9	72	148·2	...	5·48	20	4·4
Toronto	86·0	18	30·5	11	...	...	41·9	67	...	...	2·51	11	6·0
Fredericton	77·3	19	27·5	12	...	...	35·3	54	...	...	3·46	12	6·0
Winnipeg	84·3	11	17·8	6	...	...	...	...	...	...	2·97	9	...
Victoria, B.C.	72·4	8	38·2	5	...	...	...	...	...	...	1·81	9	7·0
Dawson	...	...	...	...	...	...	...	...	...	...	...	...	...

MALTA.—Mean temp. of air 63·6, or 0°·4 above the average. Mean hourly velocity of wind 9·4 miles, or 0·5 below average. Mean temp. of sea 64°·2.

MAURITIUS.—Mean temp. of air equal to, dew point 1°·1 below, and R ·23 in. above, averages. Mean hourly velocity of wind 10·3 miles, or 0·7 above average.

MADRAS.—Bright sunshine 214·1 hours.

KODAIKANAL.—Bright sunshine 238 hours.

COLOMBO.—Mean temp. of air 82·7, or 0°·3 above, of dew point 1°·1 above, and R 4·98 in. below, averages. Mean hourly velocity of wind 9·3 miles.

HONGKONG.—Mean temp. of air 76°·5. Bright sunshine 137·6 hours. Mean hourly velocity of wind 13·3 miles.

ADELAIDE.—Mean temp. 2°·4 above, R ·64 in. below, averages.

SYDNEY.—Mean temp. of air 2°·1 above, and R 2·06 in. above, averages.

WELLINGTON.—Mean temp. of air 0°·7 below average.

AUCKLAND.—Mean temp. of air 1°·0 above, R rather over half an inch above average of previous 38 years.

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FALL OF A WIRELESS TELEGRAPHY TOWER IN A GALE.

By W. A. S. DOUGLAS, M.A.

THE first Wireless Telegraphy Station to be erected in Scotland was completed early in 1906 at Machrihanish, a small village, well known to golfers, on the shores of the Atlantic, some eight miles north of the Mull of Kintyre and five miles west of Campbeltown. This tower was blown down on the afternoon of the fifth of December, during a heavy gale from the north-west, and I send a description based on my familiarity with the locality and on reports in local newspapers. The authorities in charge have given no information on the subject.

In order to understand the nature of the catastrophe it is necessary first to consider the tower and its mode of construction. The station was built by the National Electric Signalling Company of Washington, U.S.A., in order to exploit a discovery of Professor Fessenden regarding wireless telegraphy. By his method, Professor Fessenden claims that messages can be sent right across the Atlantic, and the tower was designed for the purpose of communicating with an American station near Boston. In order to insure perfect similarity in the two stations, all the machinery and materials for the station in this country were shipped from America and put together at Machrihanish. The buildings, as shown in the accompanying sketch (fig. 1), consist of a power house, with large engines and dynamos, a receiving and transmitting room, and, lastly, the lofty stalk or tower which has now been destroyed by the wind.

The height of the tower was 420 feet, and the whole structure was built of hollow steel tubes of the uniform diameter of three feet. Each tube was eight feet in length, but as there was three feet of overlap for rivetting purposes as many as eighty-four tubes were used in the construction of the tower. An iron ladder ran up the inside to the top and at each hundred feet there was an outside balcony. The foundation was the most novel feature in the whole construction. The base of the erection, as shown in fig. 3, was a large square of concrete, on the top of which insulators were placed, and then another layer of concrete, in which was embedded a pivot,

M

and upon this the tower itself rested. Therefore, the tower was free to move in any direction, and when it collapsed no injury was done to the foundation. The stalk was held in an upright position solely by means of stays made of stout wire cable. Four stays were attached to the tower at each of the four balconies and the ground

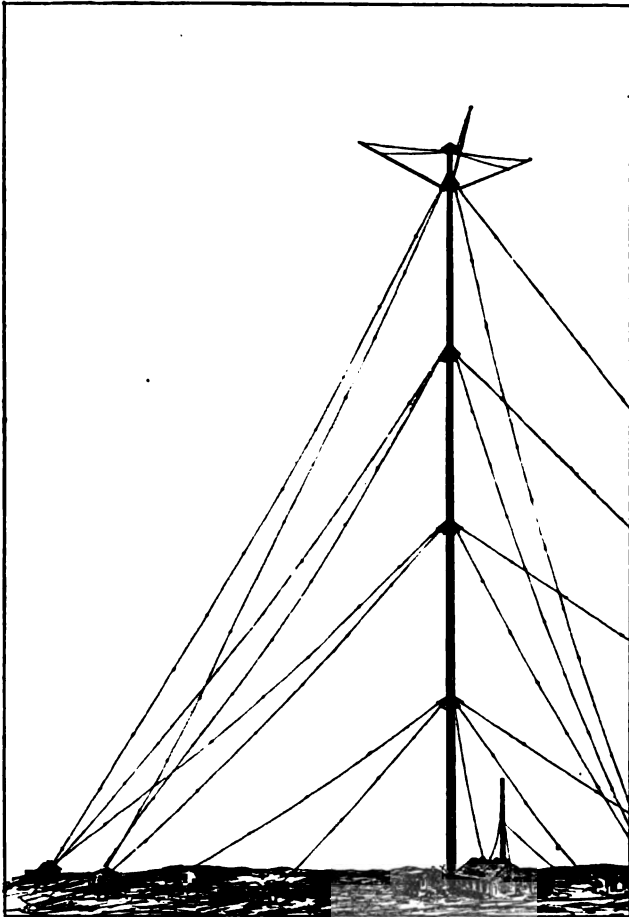


FIG. 1.—SKETCH OF TOWER, SHOWING GENERAL APPEARANCE.

ends were fastened to solid concrete foundations (fig. 2), situated at distances of from one to three hundred yards from the base of the tower at points to the east, south, west and north-west of it. By these means it seems to have been thought that the resistance of the

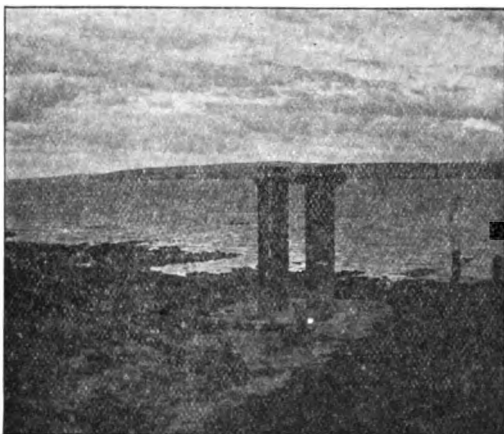


FIG. 2.—CONCRETE BLOCK, IN WHICH STAYS ARE FASTENED (DURING CONSTRUCTION).

the wind on the west coast of Scotland was strong and gusty, and Machrihanish always has its full share if any wind is about, but the tower stood the strain well and no one was anxious about its safety.

Early on the morning of Wednesday, December 5th, the wind increased greatly and soon was blowing a severe gale from the north-west. As the day advanced the gale became worse and there were frequent squalls of most exceptional severity. About noon the storm seemed to reach its height, and the tower, which was necessarily exposed to the full force of the gale, was observed to be swaying considerably. Everything, however, held fast, although the roar of the wind

tower to the wind would be greatly diminished, and any danger of its buckling obviated.

I have myself been up the tower during a stiff breeze, and even then the swaying was considerable, and the noise of the wind, as it rushed past, was most alarming and indicated that a great resistance was being opposed to its passage.

For several days before December 5th

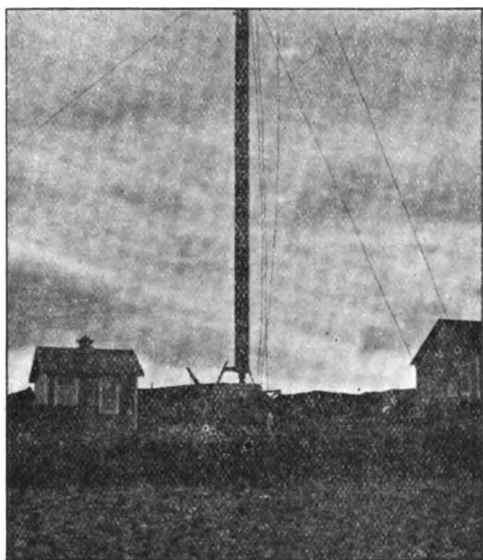


FIG. 3.—FOUNDATION OF TOWER, SHOWING PIVOT ON WHICH THE STRUCTURE RESTS.

against the stalk and stays was almost deafening. Shortly before one o'clock in the afternoon the gusts became even more severe, and, during one of exceptional velocity, without any warning the stays to the west of the tower were wrenched from their fastenings and immediately the huge erection collapsed bodily, snapping in two as it fell. The noise of its snapping, together with the crash made when it struck the ground, was heard a long distance away, and at once informed the whole village of what had happened.

Fortunately, in falling the tower cleared the buildings, though only by a few inches, and some workmen who were in the power house had a very narrow escape. It is worthy of notice that the stays were arranged so that if any one of them broke, the tower would fall clear of the buildings, and this is what actually happened. As already stated, the stalk buckled in its fall, and the two parts fell in different directions. The first section of one hundred feet, measuring from the base, fell against the wind in a northerly direction, while the top section, composed of the remaining three hundred and twenty feet, fell towards the south. Part of the tower fell on a mound, which caused it to snap yet again. The upper portion is flattened out, owing to the momentum of its fall, and parts of it are buried more than a foot deep in the ground. Many of the tubes, needless to say, are damaged beyond all hope of repair, but it is believed that it will be possible to use some fifty per cent. of them again.

It is characteristic of the energy of those responsible for the station that the manager has got instructions from America to proceed at once with the reconstruction of the tower. This may be taken as an indication that the company's officials are still hopeful of realising the object for which the station was established. It is understood that the experiments, although encouraging, did not come up to the expectations of the inventor, but everything is being conducted so quietly that it is difficult to get trustworthy information. During the summer months, from one till four in the morning, messages were being sent off daily from the station, but how many reached the other side of the ocean it is impossible to learn. The effect at Machrihanish was most remarkable, and it was well worth rising early to see it. Underneath the six acres of ground, leased by the company, a network of wire has been laid, miles of wire having been used for this purpose, and the ground has been railed off with an ordinary wire fence. When messages are being sent off the whole place seems alive with electric sparks: sparks run along the wires of the fence, sparks seem to spring out of the ground, sparks fly through the air from all directions, and their crackling noise mingled with a dull subdued roar can be heard a quarter of a mile away.

It is unfortunately very difficult to say how the accident happened. So closely are the secrets of the company kept, that it is impossible to find out what pressure of wind the tower was built to withstand,

and of course at Machrihanish such things as anemometers are unknown. We can, therefore, only approach the subject indirectly by considering three questions.

First, was the velocity of the wind greater than could have been reasonably anticipated? A north-westerly gale at Machrihanish, coming as it does over an uninterrupted stretch of ocean, is not a thing to be despised, and I was always inclined to agree with the local opinion, that the tower would never survive a winter's gales, but this opinion was entirely unscientific and may be worth little. It is surely not too much to assume that the tower was put up to withstand a greater gale than ever has blown, or is ever likely to blow, on our shores, and we may therefore answer this question in the negative *

Second, was it owing to a mistake in calculating the pressure which the wind would exert on the tower? Without doubt, the tower was put up to resist an enormous pressure, but it seems to me that the effect of an unsteady pressure, such as would be exerted by violent gusts, could not have been sufficiently considered, and that this was the primary cause of the accident.

Third, was defective material used in the construction of the tower? Possibly this should be answered in the affirmative, for the accident undoubtedly happened owing to some of the stays giving way, and this certainly suggests that a defect in one, or some, of the stays may have been the immediate cause of the whole trouble.

LOCAL CLIMATOLOGY IN RELATION TO ORCHARD SITES.

By ALFRED O. WALKER, F.L.S., F.Z.S.

It is a remarkable fact that, with all the costly meteorological establishments that we possess in this country, and the enormous mass of observations that have been recorded, scarcely any attempt has been made to utilise them for the benefit of Agriculture. Still less, if possible, has any effort been made to compare the climates of the different parts of a restricted area, such as the county of Kent. Yet it will be, I think, generally conceded that in a county in which fruit growing is such an important and increasing industry, it is of the highest importance to know where orchards may be planted with the least danger from spring frosts, such as this year have ruined the plum and damson crops.

* The wind on December 5 was undoubtedly very strong along the whole of our western seaboard. At Malin Head, 60 miles due west of Machrihanish, the Meteorological Office observer estimated it at force 10 of Beaufort's scale at 8 a.m. It is a familiar joke that force 12, the maximum of the scale, can only be recorded when observer and observatory have been blown away.

—Ed. S.M.M.

I am well aware of the difficulty of the subject, having studied it for the last thirty years. But, after all, climate is governed by natural laws, and it seems to me that some effort should be made to find out what these are. The object of this article is to show that there is a *prima facie* case for a properly organised and systematic inquiry into them.

Since I came to live at Ulcombe, on the south slope of the Lower Greensand or "Kentish Rag" hills, in 1899, I have been struck by the following facts:—

(1.) That many tender plants and shrubs will live and thrive with me which are killed by the winter in the immediate neighbourhood of Maidstone and in the Medway valley.

(2.) That the temperatures recorded in the Public Gardens at Maidstone show a climate of much greater extremes (*i.e.*, higher day and lower night temperatures) than with me. To give a recent instance of the latter, the grass temperature at Maidstone on September 28th was 33° , while with me it was 46° .

(3.) As far as can be judged from fruit crops, condition of the surface of the soil during frost, time of flowering of trees and plants in spring, &c., there appears to be a marked difference on the same slope at different heights, the middle portion having the most equable climate. At Ulcombe, the hill being about 300 feet high, the part between 50 feet and 200 feet is the warmest in winter. In this part there was this year quite half a crop of damsons and cherries, and the same was the case in 1903—an equally bad year. The lowest temperatures recorded in April and May were 31° on April 24th, by the shaded thermometer (the only occasion on which it was below 32° since March), and $28^{\circ}5$ on the grass on April 26th. It is dangerous to generalise from a single locality, but there is no obvious reason why the same conditions should not exist along the whole Lower Greensand range which runs from east to west through the whole county. Probably much the same climate exists on the parallel Chalk range, but the soil may not be suitable for fruit.

It can hardly be denied that some localities are better adapted in climate or soil, or both, than others for fruit culture, and it must surely be worth while to endeavour to ascertain the exact position of these localities. For this purpose I suggest that competent Inspectors should be appointed whose duty it should be to ascertain and record every year those orchards in which the crops were specially good or bad. In time a mass of valuable information on the subject would be acquired, which, if properly utilised, would put an end to the waste of money involved in planting orchards in unsuitable localities. It should also be part of the duty of such Inspectors to examine and report, and perhaps advise, on all cases of insect and fungoid pests affecting fruit trees.

ROYAL METEOROLOGICAL SOCIETY.

THE opening meeting of this Society for the new session was held on Wednesday evening, November 21st, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

Dr. H. R. Mill gave an account of the proceedings at the International Congress on Polar Exploration, held at Brussels from September 7th to 11th last, which he attended as the delegate of the Royal Meteorological Society. The resolutions bearing on meteorology which were adopted by the Congress were the following:—

- (1) That researches and studies be undertaken in order to construct recording instruments which may be left for longer or shorter periods in uninhabited polar regions.
- (2) That Polar Expeditions be furnished with an equipment of kites for the study of the upper air.
- (3) The Committee desire to see permanent stations installed in the countries near the poles, wherever it is possible, and to see temporary stations organised at the greatest possible number of points during the continuance of Polar Expeditions.
- (4) That Polar Expeditions should be undertaken in the two hemispheres simultaneously.
- (5) That during these expeditions meteorological and magnetic observations be made as far as possible exactly in the places where they were made during the international co-operation of 1882–83.
- (6) That detailed observations of the phenomena of the upper atmosphere be specially recommended to Polar Expeditions.
- (7) In order to secure uniformity in the meteorological and magnetic observations it is desirable that, before their departure, all Polar Expeditions should enter into communication with the permanent International Meteorological Committee.

Mr. W. Marriott read a paper on "The Abnormal Weather of the Past Summer and some of its Effects," which he illustrated with a number of lantern slides. The principal features of the weather over the greater part of England—especially the south-east—were the high state of the barometer throughout the whole of the period, except a portion of August; the high temperature in July, August and September; the great amount of sunshine; and the deficiency of rainfall. Over the south-eastern portion of England more than 900 hours of bright sunshine were recorded during the four months June to September; while at a few stations in the extreme south and on the east coast over 1000 hours were recorded. The sunshine was more than 200 hours above the average over the Thames basin

and on the coasts of Lancashire and North Wales. The most remarkable feature of the weather during the past summer was the exceptional heat wave which occurred between August 30 and September 3. The temperature rose above 90° over a large part of England on the four consecutive days—August 31 to September 3. Mr. Marriott said that he had not been able to find any previous record of readings over 90° for a similar period. The air was very clear, and brilliant sunshine prevailed over nearly the whole of the country. Another remarkable feature connected with this heat wave was the great dryness of the air; for on September 1 and 2, differences of 25° were observed between the readings of the dry and wet bulb thermometers, and relative humidities below 30 per cent. were recorded at many inland places. Owing to the great heat, vegetable matter became very inflammable, and consequently there were more stack fires than usual, and extensive stretches of heather and gorse were also set on fire. The author said that with the advent of the hot weather the death rate increased considerably; and he pointed out that when the mean maximum temperature for the week reached 72° the death rate at once began to rise. The increase of the death rate was made up almost entirely of infants under one year of age. This was shown to be due to the prevalence of epidemic infantile diarrhoea, which sets in when the mean maximum temperature for the week rises above 72° . Attention was called to the effect which the high temperature had in turning milk sour and in rendering it unfit for drinking purposes, unless it had been first Pasteurized or sterilized. Not only was the ordinary milk a source of danger to infants during the hot weather, but the great use which is now made of tinned foods also tended to produce ptomaine poisoning and cause diarrhoea. Owing to the drought "keeping" for cattle was very deficient, and consequently there was a falling off in the milk supply of as much as 30 per cent. The brilliant sunshine and the warm weather had a great effect upon holiday traffic, for more visitors than usual went to the various seaside and holiday resorts, and outdoor entertainments were successfully carried on without any interruption.

Dr. W. N. Shaw, Mr. W. H. Dines, Mr. F. J. Brodie, Captain M. W. C. Hepworth, Mr. W. W. Bryant, Dr. H. R. Mill, Mr. F. Druce, Mr. H. Southall, and the President, took part in the discussion on this paper, and Mr. Marriott replied.

The following were elected Fellows of the Society:—Mr. W. R. Baldwin-Wiseman, Assoc. M.Inst., C.E., Mr. W. W. Bryant, F.R.A.S., Lieut. Hon. F. G. P. Butler, R.N., Mr. J. R. Gibbs, Mr. H. J. W. Gidley, Prof. J. W. Hoffman, Mr. E. W. Kitchin, Assoc. M.Inst., C.E., Mrs. M. Lane, Mr. C. L. J. M. Parkinson, M.A., Mr. H. J. B. Powell, Assoc. M.Inst., C.E., Mr. A. S. Tuxford, and the Hon. H. A. Wyndham.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE GREEN FLASH.

WITH reference to the letter of Mr. R. C. Cann Lippincott on the Green Ray, in the Magazine for this month, I desire to state that on several occasions I had the opportunity of observing this phenomenon on board the "Durham Castle," while we were passing up the Red Sea. The ray appeared to me to be bluish-green, and I cannot say that I ever observed the emerald-green noticed by others. My physiological studies of subjective colour phenomena led me at first to account for the green or bluish-green ray on the physiological theory; but when I noticed that the phenomenon was seen not when the portion of the sun's disc was red, but when it had a yellowish tinge, and further when I saw the phenomenon at *sunrise*, as described by Dr. Rambaut in his admirable article, I became at once a convert to the physical theory. Dr. Rambaut's arguments are absolutely convincing, and they give a rational explanation which I feel sure will convince anyone who studies them carefully.

JOHN G. MCKENDRICK.

Mazieburn, Stonehaven, 26th November, 1906.

It is to me very difficult to understand how anyone who has observed the green flash, and has carefully read Professor Rambaut's admirable papers (pp. 21-23 and 41-45), can doubt that the true cause of the phenomenon is atmospheric dispersion. But, as at least one of your correspondents (p. 190) still believes the flash to be merely a subjective colour due to physiological causes, I should like briefly to demonstrate that such cannot be the case. The fact that the flash has often been seen just before sunrise is, as the Editor pointed out (p. 11), a disproof of the hypothesis that the appearance is due to retinal fatigue; but I wish to add from my own experience an even more conclusive disproof.

The sun was sinking behind a low horizontal narrow bank of cloud, between which and the horizon was a strip of clear sky. Just as the top of the sun disappeared behind the upper edge of the cloud, I saw a green flash, and just as the base of the sun appeared below the lower edge of the cloud, I saw a red flash.

Both flashes are simply and completely explained by dispersion, but it is impossible to explain the flashes physiologically, except on the hypothesis that the sun's disc was first red and then, a few minutes later, green! As a matter of fact, the disc was yellow all the time.

Under exceptionally good conditions, the flash is blue rather than green; and I have seen the flash change from green to blue, the blue

being followed by a faint feathery wisp of violet—a rare and beautiful close.

I may add that on clear days I have watched the low sun dozens of times with a telescope (power about 100), and have invariably noticed that the upper part of the disc is fringed with bluish-green, and the lower part with orange-red, the atmosphere acting like a prism, with the refracting edge upward. As the sun sinks, both fringes grow in colour and in breadth, and at sunset—without any breach of continuity—the upper fringe becomes the green flash, always visible in clear weather with a telescope of sufficient power, but not always developed enough to be seen by the naked eye.

It may be of interest to mention that, with the aid of a telescope, the green flash has also been seen at the setting of the planet Jupiter; and, as the image of every star observed telescopically near the horizon is drawn out into a short vertical spectrum, I see no reason to doubt that, under favourable conditions, the green flash could be telescopically observed at star-set in the case of bright stars.

C. T. WHITMELL.

Leeds, 25th October, 1906.

MR WHITMELL'S letter in your last number indicates what appears to be the best method of attacking the question why the Green Flash is so seldom seen. It is possible to guess at the reasons why he failed to see it on the four occasions specified by him, and if other competent observers were to record their experiences in like manner, it would soon be discovered whether these guesses were correct, or the explanation had to be sought elsewhere. In Nos. 1 and 2 the non-appearance of the flash may have been associated with the colour of the sun, for reasons previously stated. Another of the three determining factors referred to by Mr. Whitmell, viz.: "the refractive condition of the air," may have been responsible for the failure in the case of No. 5, as the sun set behind a ridge of Snowdon, and consequently the atmospheric refraction would not be so great as if it had set at a lower altitude. This factor may also have operated to a slight extent in No. 3, but the bank of cloud seems to have been too low to account fully for the non-appearance of the flash. Perhaps some of the less refrangible rays from the sun, which would otherwise have passed over the observer's head, may have grazed the lower surfaces of minute water drops in the cloud and been reflected downwards so as to reach the eye along with the flash, and thus neutralize its green colour.

If the green flash were a complementary effect, as suggested by Mr. Lippincott, it should be best seen when the sun is of a reddish colour, but the reverse is rather found to be the case.

ALEX. THURBURN.

Keith.

WHY?

THE children in a country school (who keep a rain record) propounded two questions a week or two ago, which I found it difficult to answer. Perhaps you will kindly inform them and me—

- (1) Why do rain-drops differ so much in size?
- (2) Why is the distant view, across the Severn to the Welsh hills, often so remarkably clear before rain? A. F.

[These questions are easy to ask, but though we could discourse on both topics for a considerable time, we could not formulate concise replies that would have any chance of satisfying the questioners. We invite answers from our readers, but restrict each answer to fifty words as a maximum.—ED. *S.M.M.*]

THE SUMMER RAINFALL OF 1906.

If it is not too late, I should like to put before your readers some figures of the Mid-Wessex Rainfall Association which will serve to corroborate *both* sides of the contrast given in letters which you have published—from Mr. Horner, of Worthing, in September, and from Earl Waldegrave, of Chewton Priory (on the N. slope of the Mendip Hills) in October, the first affirming a remarkable summer drought, the second a very ample summer rainfall.

Our Association covers an area of about 35 miles diameter, with 32 corresponding members. On its outer edge are found Glastonbury, Cranmore, Mere (Wilts), Shaftesbury, Sturminster Newton, Sherborne, Beaminster, Crewkerne and Langport. If through the centre of this district a line be drawn E. and W., the region to the S. of it is that where most rain was to be expected, and where in January, February, October and November most actually fell. But for seven months in succession, March to September, this condition was most remarkably reversed. Towards Devon and in Dorset the rainfall was very low through all those months. Even in May two stations near the Devonshire border registered less than 2 inches, and in other months totals below 1 inch were common to the S. of the said line. But to the N. of it May gave from 4 to 5½ inches, and in the three summer months there was not even one case of a monthly total below the inch. In September half our stations recorded less than an inch, but all those which reported less than .80 in. were either on the line or well to the south of it.

The northernmost of our stations is at Cranmore Hall Gardens, 8 miles from Chewton Priory, at the same elevation, *i.e.*, nearly 600 ft., but on the S. side of the Mendip ridge. Here the rainfall for June, July and August was 6.82 in., being the highest but one on our list, and not so very far short of Earl Waldegrave's 8.75 in.

Our southernmost station is Beaminster, ordinarily having much the same rainfall as Cranmore. Its rainfall for the same period was

3.64 in., quite the lowest on our list, and not so very much more than Mr. Horner's 2.97 in.

Careful records have been kept at Cranmore now for 20 years, and Mr. Moore reports that this year's aggregate for the first 11 months has in that time been exceeded only twice—viz., in 1894 and 1903.

H. A. BOYS, F.R.Met.Soc.

North Cadbury Rectory, Somerset, Dec. 4th, 1906.

METEORS AND FIREBALLS.

MR. HUNTLEY has put a “?” after his title “an audible meteor” on p. 190. I do not know whether he doubts that what he saw was a meteor, or that a meteor emits an audible sound. That there is no room for doubt on the latter point is proved by many instances, of which I may recall a few—for memory as to such things is short-lived.

The great meteor of November 20th, 1887, was heard at many points throughout its course from Newmarket to near Swindon. See *Met. Mag.*, Vol 22, pp. 161–167; also *Trans. Hertford Nat. Hist. Society*, Vol. 5, part 2.

That of January 25th, 1894 (*Met. Mag.*, Vol. 29, p. 8) was heard across Herefordshire, Worcester and Gloucestershire.

The Madrid meteor of February 10th, 1896 (*Met. Mag.*, Vol. 31, pp. 11, 25) produced a sound which lasted two minutes.

The daylight meteor of January 9th, 1900 (*Met. Mag.*, Vol. 35, p. 6) produced “sounds resembling peals of thunder”; and, elsewhere, “a long trail of smoke with a rumbling noise in the air.”

Whether the sounds which accompanied the Hereford earthquake and meteors of December 17th, 1896, were due at all to the latter must remain an open question.

The Editor's note on “The Fireball of May 13th” (p. 191), “that it does not follow that the impression produced on the eye by a sudden light corresponds to the real phenomenon,” recalls an occurrence which I received a full account of at the time, but have not hitherto reported.

It happened sometime since at a large isolated house in Herefordshire. A heavy thunderstorm was in progress. A visitor, a scientific observer, was watching it from the dining-room window, which looks east over the lawn and grounds in front of the house away to the Malvern Hills. The servants were in the servants' hall at the back of the house, with windows looking south into a large courtyard surrounded, except to the west, by high buildings. A loud explosion was heard. The visitor in the dining-room saw a large ball of fire apparently descend and burst upon the lawn. At the same moment, the servants saw a similar ball descend and burst upon the woodstack in the S.W. corner of the courtyard. Careful

examination immediately followed. No damage was found to any of the buildings or the lawn, and the woodstack was undisturbed.

Unless we assume a plurality of "fireballs" at the same instant (for there was but one explosion), which seems most improbable, it is obvious that none of the observers saw the actual flash. Their eyes were affected by the effect of the sudden light of the flash (wherever it was) upon the particular point to which their gaze at the moment was directed; in the one case the lawn, in the other the woodstack.

I have long doubted whether the zig-zag lines which we are accustomed to regard as the actual discharges are such in fact; at least in many instances. That we do often see the actual discharge I do not deny. This doubt was borne in upon me while observing a storm at Charlton Kings, August 21st, 1898 (*Met. Mag.*, Vol. 33, p. 136). The storm with heavy rain approached from the direction of Gloucester. I noticed several flashes all taking, apparently, the same zig-zag path. Suddenly the rain ceased, the nimbus cloud opened in a great rift, revealing behind it a sharply-defined mass of electrical cumulus with an edge, lit by the setting sun, exactly in the position of, and with an outline corresponding to, the apparent path of the flashes which I had been watching. Evidently what I had seen was the reflection from the surface of the cloud of a flash behind or within the cloud.

If this is so, it explains the phenomena of the ribbon-flash frequently seen in photographs. If a second discharge occurs before the plate is removed a second image of the outline of the cloud would appear at a slight distance from, but parallel to, the former figure, the cloud having moved slightly between the two discharges, and thus the combined images would present the appearances of a ribbon with two bright edges, the interval being affected by a double exposure.

The phenomenon at Morchard Bishop appears to me explicable as follows. The observer looking through the space between the trees could not locate either the distance or the plane of what he thought was the descent of a ball. The apparent breaking up of the ball into sparks of fire would be the lighting up of a low bank of ragged clouds. Those who watched the storm of August 2nd in this year, will see an analogy to the extraordinary coruscations then observed, only those appeared to pass upward instead of downward.

JAMES G. WOOD.

115, Sutherland Avenue, W., November 17th, 1906.

[In justice to Mr. Huntley, we must state that the title of his letter, "?" and all, was editorial, but in justice to ourselves we may point out that in the "Contents" the "?" was removed on the better impulse of a second thought.—ED., *S.M.M.*]

A LUNAR DOUBLE RAINBOW.

It may interest your readers to learn that shortly before 8 o'clock of the evening of Thursday, November 29th, a splendid lunar double rainbow with prismatic colours was seen from this, stretching across the western horizon. In the primary bow the several colours of the spectrum were clearly visible. The secondary arch was faint and gave the pale white light usual in lunar rainbows. A moderate W.S.W. gale was blowing at the time, and on it were borne numerous showers of fine rain. While the beautiful bow adorned the western horizon, in the eastern part of the zenith a coloured corona surrounded the moon. A double coloured lunar rainbow is, I believe, very uncommon. The phenomenon was greatly admired by all those who were fortunate enough to observe it.

ARTHUR R. MOORE, B.A., B.L.

40, Fitzwilliam Square West, Dublin, Dec. 4th, 1906.

RAINBOWS.

THIS afternoon we saw a *very* bright, but not perfect, treble rainbow, partly as sketched below (Fig. 1)—the top parts invisible, the lower parts of all three very bright. Some 30 years ago I saw a *perfect* treble rainbow, but cannot quite remember whether the top was pointed or shaped like an egg, as I have sketched (Fig. 2). At that



time there was also another faint round one, making *four*. Are they often seen?

W. R. NASH.

Carke-in-Cartmel, 17th October, 1906.

AURORA BOREALIS.

A *VERY* bright display of Aurora was visible here on November 16th, being first observed at 6 a.m., about an hour and a half before sunrise. The greater part of the sky was covered with thin cirro-stratus, through which the brighter stars were visible. The primary arc of the Aurora spanned the sky from about N.E. to S., and was distinctly brighter on the N.E. side. Beneath the lowest arc the segment of sky was of a greyish hue. It was apparent that several arcs entered into the composition, the lowest being of a deep greenish blue hue, the second a vivid yellow, and the whole being

surmounted by an arc of a rosy hue. From the primary arc there was a frequent display of rays and streamers, varying in colour from pale pink to blood red, and appearing to spring from a centre at about E.S.E. Much of the brilliance of the display was lost, owing to the rapid approach of dawn, but distinct traces of the phenomenon were still visible at 7.15 a.m., and then appeared to be slowly breaking up, the red being the last to disappear. At 9 a.m. on the same day there was a very bright prismatic solar halo, and in the S.E. a peculiar shimmering glow of a pink hue, varying in intensity of colour, with a twitching movement.

It is certainly a somewhat remarkable coincidence that the last brilliant auroral display occurred almost exactly a year ago, November 15th, 1905. (See this Magazine for December, 1905.)

SPENCER C. RUSSELL, F.R. Met. Soc.

Parkside, Ashley Road, Epsom, Nov. 17th, 1906.

METEOROLOGICAL NEWS AND NOTES.

PROFESSOR MASCART is, we learn, retiring from the position of Director of the Central Bureau of Meteorology in Paris, and he will be succeeded in that post by M. Angot.

INFORMAL METEOROLOGICAL DISCUSSIONS have again been arranged at the Meteorological Office, 63, Victoria Street, Westminster, for the purpose of considering important contributions to Meteorological literature, particularly papers by foreign and colonial authors. Two meetings have already been held, the remainder are provisionally arranged for the following Mondays in 1907, at 5 p.m.: January 14th and 28th, February 11th and 25th, March 11th and 25th. Dr. Shaw will be glad if any persons interested in meteorology would attend and take part in the discussions.

MR. W. MARRIOTT will lecture on meteorological subjects on behalf of the Royal Meteorological Society at the Literary and Scientific Institution, Highgate, on December 18th, and to the Young People's Society at the Oaklands Congregational Church, Uxbridge, on January 15th.

THE RAINFALL OF NOVEMBER, 1907, in the British Isles, was remarkably uniform over the country, the dry eastern regions showing a large excess over the average, and the wet western regions showing a corresponding deficiency. Ireland was very dry, especially in the south; and the whole of Cornwall, Devon, Somerset, Wales, Cheshire, part of Lancashire, the Southern Uplands, and west coast of Scotland had less than the average, while several stations in Kent had nearly twice the average fall, and some in the north-east of Scotland more than twice. The eleven months of 1907 showed a close approach to average rainfall. The general percentage of the average for England and Wales was 101, for Scotland 108, and for Ireland 95; the British Isles as a whole coming out at 101.

TEMPERATURE FOR NOVEMBER, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				No. of Night frost below 32°	
					Max.		Min.		Shade.	Grass.
					°	Date.	°	Date.		
Camden Square.....	London.....	51 32	0 8	111	60·1	22	29·7	19	3	5
Tenterden.....	Kent.....	51 4	0 41	190	60·0	22	31·0	19	1	7
West Dean.....	Hampshire.....	51 3	1 38	137	59·0	22	22·0	13	5	11
Hartley Wintney.....	".....	51 18	0 53	222	59·0	22	24·0	12	5	8
Hitchin.....	Hertfordshire.....	51 57	0 17	238	61·0	22	28·0	13†	4	...
Winslow (Addington).....	Buckinghamsh. r.	51 58	0 53	309	60·0	22	26·0	19	4	11
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	0 40	226	60·5	21	28·5	19	4	...
Brundall.....	Norfolk.....	52 37	* 1 26	66	...	...	...	...	...	...
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	57·0	22	24·7	13	8	12
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	59·2	22	32·7	13	0	7
Polapit Tamar (Launceston).....	".....	50 40	4 22	315	58·5	22	21·5	13	6	13
Bath.....	Somerset.....	51 23	2 21	67	60·2	22	24·5	13	7	...
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	60·0	22	29·0	12	4	...
Church Stretton (Woolstaston).....	Shropshire.....	52 35	2 48	800	58·0	22, 25	23·5	19	16	...
Bromsgrove (Stoke Reformatory).....	Worcestershire.....	52 19	2 4	225	58·0	22	24·0	18	10	...
Boston.....	Lincolnshire.....	52 58	0 1	25	60·0	22	29·0	19	2	...
Workshop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	59·9	22	29·2	6	4	13
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	...	...	...	...	...	...
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	59·0	22	30·5	19	1	10
Wetherby (Ribston Hall).....	Yorkshire, W. R.	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage.....	".....	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park).....	" E. R.	53 45	0 20	6	60·0	22	30·0	19	2	9
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	56·6	24	32·6	19	0	...
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street).....	Pembroke.....	51 48	4 58	95	58·5	21	30·2	5	5	12
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	58·0	22	23·0	10	...	...
Llandudno.....	Carnarvon.....	53 20	3 50	72	62·0	22	34·0	14	0	...
Cargen (Dumfries).....	Kirkcudbright.....	55 2	3 37	80	58·0	22, 23	29·0	19	4	...
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	58·0	25	26·0	18	7	14
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	60·3	24	33·4	18	0	4
Colmonell (Clachant).....	Ayr.....	55 8	4 54	140	57·0	21	27·0	9	2	...
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	57·0	21, 22	32·0	5 8	4	18
Tighnabruaich.....	Argyll.....	55 55	5 14	50	...	...	28·0	9	8	9
Mull (Quinish).....	".....	56 36	6 13	35	57·0	22	...	...	...	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	58·4	22	32·0	10	1	...
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford).....	".....	57 8	2 7	120	58·0	24, 28	26·0	20	6	...
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendampth).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	62·0	23	31·0	21	4	...
Castletown.....	Caithness.....	58 35	3 23	100	62·0	23	28·0	10	8	10
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	63·0	25	29·0	1	...	...
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	56·5	16, 26	26·0	3	5	...
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	59·0	25	26·0	19	7	...
Carlow (Browne's Hill).....	Carlow.....	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	64·4	24	33·0	20	0	7
Ballinasloe.....	Galway.....	53 20	8 15	160	67·0	22, 23	24·0	2	9	...
Clifden (Kylemore House).....	".....	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscroe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...	...
Seaforde.....	Down.....	54 19	5 50	180	55·0	22	29·0	10	4	8
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	59·0	22, 23	27·0	17	9	10

† and 19, 20. ‡ and 9, 18, 20. and 17, 21, 22.

RAINFALL FOR NOVEMBER, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
"r. 1-99.	1906.	Diff. from Av. in.	% of Av.	Max. in 24 hours.	No. of Days		Aver. 1870-99.	1906.	Diff. from Aver. in.	% of Av.		
in.	in.			in.	Date.	Days	in.	in.		in.		
45	4.20	+1.73	171	.93	8	17	23.04	22.06	— .98	96	25.16	Camden Square
22	5.80	+2.58	180	.88	4	22	25.62	25.35	— .27	99	28.36	Tenterden
25	4.05	+ .80	125	.95	8	21	27.19	28.05	+ .86	103	29.93	West Dean
03	3.96	+ .93	131	.85	8	18	24.55	24.26	— .29	99	27.10	Hartley Wintney
56	4.02	+1.46	157	1.26	.8	17	22.61	23.23	+ .62	103	24.66	Hitchin
63	3.89	+1.26	148	1.67	8	14	24.48	23.53	— .95	96	26.75	Addington
50	3.83	+1.33	153	.77	8	16	23.28	24.65	+1.37	106	25.39	Westley
71	4.25	+1.54	137	.95	8	22	23.27	26.23	+2.96	113	25.40	Brundall
32	4.77	— .05	99	1.03	20	19	34.87	36.71	+1.84	105	39.00	Winterbourne Stpln
71	3.48	— .23	94	.78	8	20	31.54	27.00	—4.54	86	35.00	Torquay
29	4.17	— .12	97	.78	20	21	34.46	35.55	+1.09	103	38.85	Polapit Tamar
06	3.00	— .06	98	.85	8	17	27.99	25.37	—2.62	91	30.75	Bath
99	3.79	+ .80	127	1.37	8	16	27.37	25.37	—2.00	93	29.85	Stroud
18	3.60	+ .42	113	.75	8	20	30.12	26.97	—3.15	90	33.04	Woolstaston
27	2.33	+ .06	103	.54	8	10	22.55	21.49	—1.06	95	24.50	Bromsgrove
14	2.84	+ .70	133	.70	8	16	21.51	21.40	— .11	99	23.30	Boston
10	2.72	+ .62	130	.67	8	16	22.68	20.90	—1.78	92	24.70	Hodsock Priory
28	2.60	+ .32	114	...	...	...	23.90	21.73	—2.17	91	26.18	Derby
91	3.74	— .17	96	.67	16	18	38.24	44.64	+6.40	117	42.43	Bolton
23	3.67	+1.44	165	.70	4	20	24.77	25.55	+ .78	103	26.96	Ribston Hall
00	7.70	+1.70	128	1.20	29	25	54.55	62.33	+7.78	114	60.96	Arneliffe Vic.
45	3.61	+1.16	147	1.13	8	17	24.66	23.48	—1.18	95	27.02	Hull
65	3.32	+ .67	125	1.03	2	18	25.35	26.35	+1.00	104	27.99	Newcastle
91	13.85	— .06	100	2.30	28	20	117.98	118.91	+ .93	101	132.68	Seathwaite
26	3.85	— .41	90	.82	20	20	38.38	40.74	+2.36	106	42.81	Cardiff
41	4.23	—1.18	78	.86	20	21	42.66	45.56	+2.90	107	47.88	Haverfordwest
68	3.09	—1.59	66	.64	18	17	40.92	42.37	+1.45	104	45.41	Gogerddan
38	2.46	— .92	73	.66	18	15	28.03	29.08	+1.05	104	30.98	Llandudno
50	3.46	—1.04	77	.54	2	16	38.75	41.25	+2.50	106	43.43	Cargen
29	2.88	— .41	88	.31	1	21	29.86	31.62	+1.76	106	33.04	Riddell House
...	3.61	...	...	.61	7	20	...	30.07	...	...	...	Edinburgh
87	3.30	—1.57	68	.74	2	18	40.03	36.94	—3.09	92	44.85	Colmonell
48	4.32	+ .84	124	.57	29	19	32.27	36.59	+4.32	113	35.80	Glasgow
21	5.84	— .37	94	.85	29	21	51.57	60.27	+8.70	117	57.90	Tighnabruaich
43	5.43	—1.10	84	.72	21	22	51.05	48.17	—2.88	94	57.53	Quinish
76	3.75	+ .90	136	.85	1	17	26.22	24.95	—1.26	95	28.95	Dundee
94	6.72	+2.78	171	...	...	...	32.92	35.04	+2.12	106	36.07	Braemar
47	4.34	+ .87	125	.78	5	19	29.62	31.47	+1.85	106	33.01	Aberdeen
65	5.24	+2.59	198	1.06	17	20	26.84	29.98	+3.14	112	29.37	Cawdor
98	6.71	+ .73	112	1.25	29	18	49.33	53.52	+4.19	108	56.00	Invergarry
79	11.75	+1.96	120	1.87	17	23	77.46	84.95	+7.49	110	86.50	Bendamp
26	8.66	+5.40	266	1.77	19	20	28.21	38.19	+9.98	135	31.60	Dunrobin Castle
...	5.97	...	...	.87	17	28	...	34.47	...	...	...	Castletown
85	3.08	—2.77	53	.66	22	23	51.47	41.41	—10.06	80	58.11	Killarney
91	2.17	—1.74	56	.71	20	14	34.99	30.93	—4.06	88	39.30	Waterford
19	1.58	—1.61	50	.28	20	17	30.10	33.21	+3.11	110	33.47	Hurdlestown
14	1.67	—1.47	53	.30	14	14	30.98	25.47	—5.51	82	34.44	Carlow
60	1.56	—1.04	60	.26	4	17	25.36	21.00	—4.36	83	27.75	Dublin
60	1.62	—1.98	45	.24	29	21	33.41	33.67	+ .26	101	37.04	Ballinasloe
25	5.52	—2.73	67	.60	14	19	71.24	65.14	—6.10	91	80.23	Kylemore House
63	3.46	—2.17	61	.78	21	23	44.69	45.42	+ .73	102	50.50	Ennisceoe
94	2.74	—1.20	70	.39	19	20	34.97	30.59	—4.38	87	38.61	Seaford
19	4.62	+ .43	110	.49	19	21	36.89	38.47	+1.58	104	41.20	Londonderry
53	3.74	+ .21	106	.45	18, 26	21	34.08	39.00	+4.92	114	37.85	Omagh

SUPPLEMENTARY RAINFALL, NOVEMBER, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	6.04	XI.	Rhayader, Tyrmynydd	5.62
„	Ramsgate, West Cliff Villas	4.57	„	Lake Vyrnwy	4.99
„	Hailsham	7.26	„	Llangyhanfal, Plas Draw	2.18
„	Crowborough, Uckfield Lodge	8.92	„	Criccieth, Talarvor	1.91
„	Osborne, Newbarn Cottage	4.74	„	Llauberis, Pen-y-pass	11.90
„	Emsworth, Redlands	4.73	„	Lligwy	2.89
„	Alton, Ashdell	4.81	„	Douglas, Woodville	4.30
„	Newbury, Welford Park	5.20	XII.	Stoneykirik, Ardwell House	3.25
III.	Harrow Weald, Hill House	4.14	„	Dalry, The Old Garroch	5.99
„	Oxford, Magdalen College	3.20	„	Langholm, Drove Road	4.77
„	Bloxham Grove	3.59	„	Moniaive, Maxwellton House	3.93
„	Pitsford, Sedgebrook	3.60	XIII.	N. Esk Reservoir [Penicuik]	6.60
„	Huntingdon, Brampton	4.02	XIV.	Maybole, Knockdon Farm	3.40
„	Wisbech, Bank House	2.90	XV.	Campbeltown, Witchburn	5.91
IV.	Southend Water Works	4.37	„	Inveraray, Newtown	7.63
„	Colchester, Lexden	4.09	„	Ballachulish House	6.48
„	Newport, The Vicarage	4.12	„	Islay, Eallabus	5.00
„	Rendlesham	4.01	XVI.	Dollar Academy	4.71
„	Swaffham	3.44	„	Loch Leven Sluice	4.64
„	Blakeney	3.78	„	Balquhiddier, Stronvar	„
V.	Bishops Cannings	3.31	„	Perth, Pitcullen House	3.57
„	Ashburton, Druid House	4.44	„	Coupar Angus Station	3.67
„	Okehampton, Oaklands	4.55	„	Blair Atholl	4.29
„	Hartland Abbey	3.17	„	Montrose, Sunnyside Asylum	3.87
„	Lynmouth, Rock House	5.20	XVII.	Alford, Lynturk Manse	6.78
„	Probus, Lamelyn	3.78	„	Keith Station	7.66
„	Wellington, The Avenue	3.27	XVIII.	N. Uist, Lochmaddy	4.09
„	North Cadbury Rectory	2.96	„	Alvey Manse	6.26
VI.	Clifton, Pembroke Road	2.90	„	Loch Ness, Drumnadrochit	3.45
„	Moreton-in-Marsh, Longboro'	3.51	„	Glencarron Lodge	11.38
„	Ross, The Graig	2.42	„	Fearn, Lower Pitkerrie	5.46
„	Shifnal, Hatton Grange	3.04	XIX.	Invershin	8.19
„	Cheadle, The Heath House	3.03	„	Altnaharra	8.66
„	Coventry, Kingswood	2.98	„	Bettyhill	6.78
VII.	Market Overton	4.01	„	Watten Station	4.58
„	Market Rasen	3.85	XX.	Dunmanway, The Rectory	4.07
„	Bawtry, Hesley Hall	2.58	„	Cork	3.14
VIII.	Neston, Hinderton	1.81	„	Darrynane Abbey	3.50
„	Southport, Hesket Park	2.48	„	Glenam [Clonmel]	2.04
„	Chatburn, Middlewood	4.59	„	Ballingarry, Gurteen	1.88
„	Cartmel, Flookburgh	3.91	„	Miltoyn Malbay	3.01
IX.	Langsett Moor, Up. Midhope	5.70	XXI.	Gorey, Courtown House	2.22
„	Scarborough, Scalby	3.68	„	Moynalty, Westland	1.91
„	Ingleby Greenhow	4.86	„	Athlone, Twyford	1.41
„	Mickleton	3.85	„	Mullingar, Belvedere	2.44
X.	Bardon Mill, Beltingham	3.35	XXII.	Woodlawn	2.23
„	Ewesley, Fallowles	4.27	„	Westport, Murriak Abbey	2.96
„	Ilderton, Lilburn Cottage	2.65	„	Collooney, Markree Obsy	2.82
„	Keswick, York Bank	4.84	„	Enniskillen, Portora	2.87
XI.	Llanfrecfa Grange	3.55	XXIII.	Warrenpoint, Summer Hill	2.53
„	Treherbert, Tyn-y-waun	7.94	„	Banbridge, Milltown	2.62
„	Carmarthen, The Friary	4.32	„	Belfast, Springfield	3.41
„	Castle Malgwyn [Lechryd]	3.33	„	Bushmills, Dundarave	3.90
„	Plymlimon	10.65	„	Stewartstown, The Square	2.69
„	Tall-y-llyn	3.70	„	Killybegs	7.73
„	New Radnor, Ednol	4.24	„	Horn Head	4.88

METEOROLOGICAL NOTES ON NOVEMBER, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Another persistently mild month; the max. temp. failed to reach 50° on 6 days only, and the mean temp. was 46°·7, or 3°·7 above the average. The first and third weeks were decidedly wet, and sunless and gloomy conditions were prevalent almost throughout. Duration of sunshine 29·9* hours and of R 68·3 hours.

TENTERDEN.—The wettest month since February, 1900, and the wettest November since 1877; but notwithstanding, the well water was at the same level as in August. Mean temp. 47°·1. Duration of sunshine 44·5† hours.

CROWBOROUGH.—Gloomy and wet with few sunny intervals. The R was more than double the average of 35 years and the greatest in November since 1877, when 9·04 in. fell. Mean temp. 45°·3.

OSBORNE.—R 50 per cent. above the average of 48 years.

TORQUAY.—Duration of sunshine 72·9* hours, or 3·6 hours above average. Mean temp. 47°·6, or 0°·2 above the average. Mean amount of ozone 4·1.

ROSS.—The last week was very fine and warmer than ever known so late in November. The max. temp., 60°·7 on 22nd, was also a record. Much fog.

BOLTON.—Generally mild and open, with deficiency of sunshine. The duration of sunshine was only 14·1 hours, or 9·7 hours below the average. Mean temp. 44°·7, or 1°·9 above the average.

SOUTHPORT.—Characterized by numerous trying changes of temp., including an unusually low min. and an exceptionally high max. Mean temp. 45°·4, or 1°·4 above the average. Duration of sunshine 45·6* hours, or 3·4 hours below the average, and of R 43·1 hours.

CARMARTHEN.—Generally wet, gloomy and dull, with few fine dry days. Mild, with only slight frosts, the foliage remained unusually long on the trees.

DOUGLAS.—Wet and sunless, with an almost unbroken series of gales, especially severe at night. Cold to 22nd, but very mild thereafter, the temp. exceeding the average by upwards of 6° in the last week.

COUPAR ANGUS.—The mean temp., as in the three preceding months, was above the average, being 43°·4. R 73 in. above the average.

BLAIR ATHOLL.—Remarkably mild, especially from 21st to 29th. On 12th and 13th ripe raspberries were gathered in the open garden.

LYNTURK.—The R was much above the average, 3·00 in. falling on 1st and 2nd and 4·63 in. on the first five days. Strong winds in the latter half.

DRUMNADROCHIT.—R 33 in., and rain days 6, above the average of 20 years. The whole month was genial with high temp., and its chief feature was the extraordinary rise of temp. on the morning of 22nd.

WATKIN.—Wet and stormy with fine and mild intervals; little frost.

DUNMANWAY.—A mild month, especially from 21st to 29th, with little frost. The R was not large for November, but the atmosphere was extremely damp from 21st to the end.

CORK.—R 92 in. below, and mean temp. 1°·3 below, the average.

DARRYNANE.—R 68 per cent. of the average.

MARKREE OBSERVATORY.—On the whole mild and damp, but the R was not above the average. Several gales with H from 15th to the end.

DUBLIN.—Open, cloudy and windy, but with quiet cold spells at the beginning and from 17th to 21st. On the latter date a remarkable period of warmth began suddenly, lasting till the close. The mean temp. of 22nd was 60°·0, or 16°·0 above the average, and the mean temp. of the month was 47°·6, or 2°·2 above the average. Sharp TS on 4th.

OMAGH.—The month commenced damp and humid, giving way in the second week to a spell of remarkably fine and rainless weather. Another wet, cold and stormy interval occurred from 13th to 21st, but the mildness of the remainder of the month was quite extraordinary.

* Campbell-Stokes.

† Jordan.

Climatological Table for the British Empire, June, 1906.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.	Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
London, Camden Square	60·9	20	39·8	5	71·7	49·5	51·5	75	131·9	32·9	2·89	8	...
Malta.....	89·0	30	58·3	11	80·3	64·6	62·3	75	...	52·1	·07	2	2·9
Lagos.....	87·5	11	71·0	15	83·9	73·9	78·6	80	137·0	69·0	22·30	21	8·1
Cape Town	75·2	15	40·6	27	62·6	50·1	48·8	78	...	...	2·63	13	5·8
Durban, Natal	82·4	17	50·8	27	76·7	54·6	...	...	132·4	...	1·02	5	1·9
Johannesburg	66·5	21	25·7	24	59·6	41·5	35·1	63	124·8	21·2	·00	0	0·9
Mauritius.....	79·1	12	53·5	30	76·4	62·1	59·8	75	138·0	46·4	1·80	16	6·3
Calcutta.....	100·2	2	74·7	7	93·2	79·1	77·8	80	158·7	72·1	6·38	9	7·4
Bombay.....	93·2	6	75·2	13	87·8	79·0	77·1	82	138·8	73·9	13·20	22	7·8
Madras.....	106·1	2	75·8	14	97·8	80·8	78·9	69	149·5	74·5	2·40	6	6·4
Kodaikanal	74·6	...	50·7	16	65·6	53·8	51·5	77	145·6	39·2	2·06	16	7·8
Colombo, Ceylon.....	88·2	2, 3, 5	73·4	22	86·7	73·2	74·0	80	149·0	72·8	3·66	18	6·7
Hongkong.....	90·6	20	74·2	2	87·2	78·9	75·4	79	145·6	...	5·90	16	6·5
Melbourne.....	69·0	2	33·7	11	59·6	46·7	45·1	78	118·7	28·0	1·51	10	6·3
Adelaide.....	70·2	2	44·5	11	62·7	50·1	48·7	78	122·1	37·1	5·18	16	6·5
Coolgardie	75·9	13	36·0	17	63·6	44·6	42·8	66	136·8	29·9	1·31	6	4·4
Sydney.....	68·9	19	43·1	25	62·4	49·5	45·5	79	102·4	31·9	1·83	23	4·2
Wellington	58·5	6	34·5	26	54·2	44·0	42·7	78	101·0	25·0	2·42	12	5·2
Auckland.....	63·0	8	39·0	11	56·7	47·1	44·9	80	112·0	32·0	1·54	11	5·7
Jamaica, Negril Point..	89·7	23	70·4	30	86·0	74·3	74·5	82	...	...	8·44	12	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada.....	86·0	1	70·0	22	83·1	73·8	71·2	81	143·0	...	12·90	29	5·2
Toronto.....	91·0	29	42·2	12	...	...	...	...	...	...	3·80	16	6·0
Fredericton	88·7	19	33·5	12	...	...	...	55	...	...	2·53	10	4·0
Winnipeg.....	84·8	14	42·2	4	...	...	...	72	...	...	6·30	13	6·0
Victoria, B.C.	77·5	24	42·4	14	...	...	...	...	...	...	·65	14	5·0
Dawson.....	...	...	...	...	...	...	...	...	...	...	...	...	...

MALTA.—Mean temp. of air 71°·0, or 0°·6 below the average. Mean hourly velocity of wind 9·2 miles, or 0·5 above average. Mean temp. of sea 70°·9.

LAGOS.—On the 26th, 8·30 in. of B fell.

MAURITIUS.—Mean temp. of air 0°·3, dew point 1°·3, relative humidity 2 per cent., and B 28 in. below, averages. Mean hourly velocity of wind 9·4 miles.

KODAIKANAL.—Bright sunshine 90 hours. Much cloud and B below average.

COLOMBO.—Mean temp. of air 81°·9, or 0°·8 above, of dew point 0°·1 below, and B 4·39 in. below, averages. Mean hourly velocity of wind 9·7 miles.

HONGKONG.—Mean temp. of air 82°·4. Bright sunshine 246·5 hours or 95·3 hours above, and B 10·9 in. below, averages. Mean hourly velocity of wind 10·3 miles.

ADELAIDE.—Mean temp. of air 56°·4, or 3°·0 above, and B 2·22 in. above, average. Only one wetter June in the 50 years, viz., 6·02 in 1887.

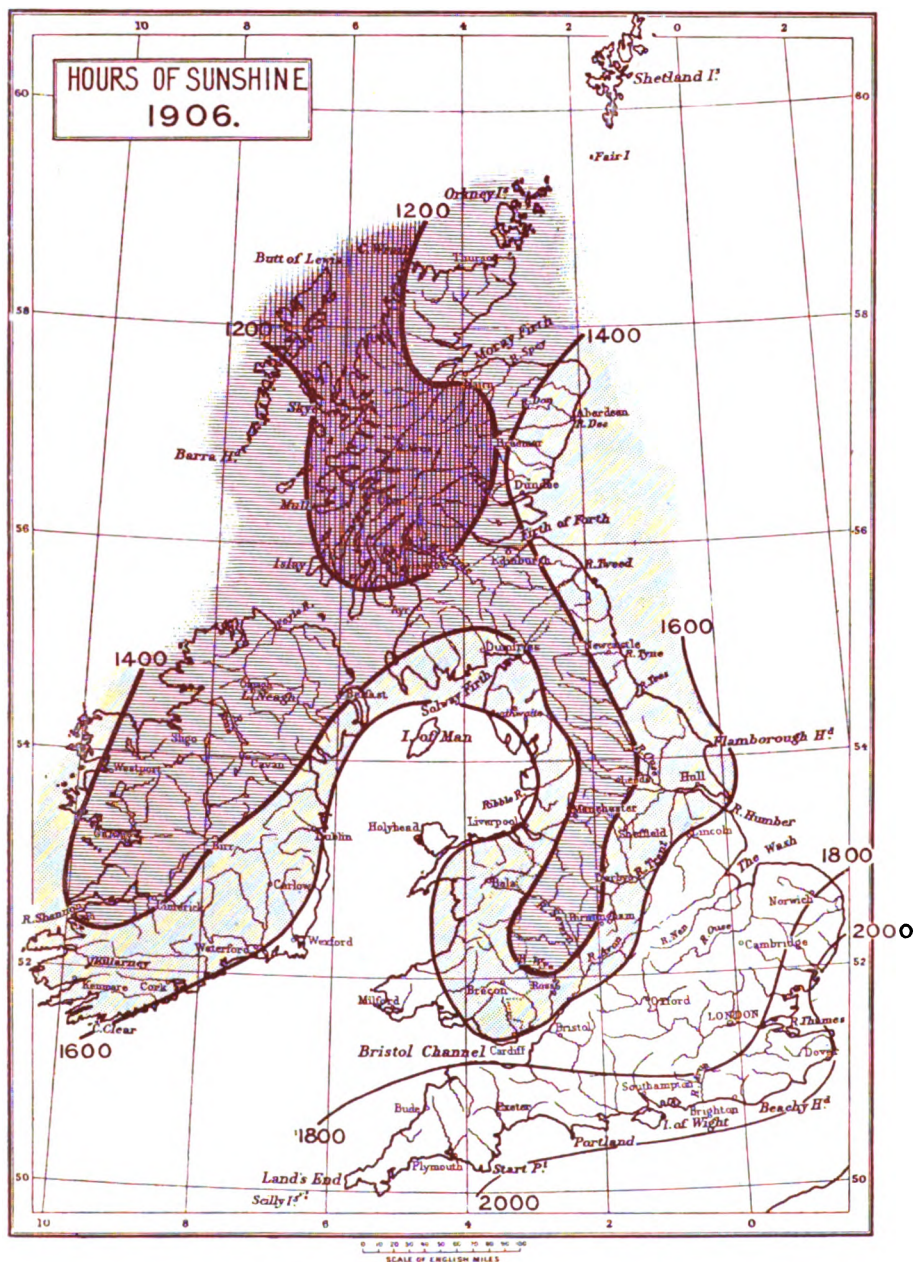
SYDNEY.—Mean temp. of air 1°·6 above, and B 3·51 in. below, averages.

WELLINGTON.—Mean temp. of air 0°·4 below, and B 2·65 in. below, averages.

AUCKLAND.—Mean temp. of air 2°·0 below, B one-third of the average and the lowest rainfall for June except 1890.

DISTRIBUTION OF BRIGHT SUNSHINE IN 1906.

By R. H. CURTIS.



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BRIGHT SUNSHINE IN 1906.

By R. H. CURTIS.

FROM a meteorological point of view, the year which has recently closed was a remarkable one in more than one respect, and not least so in regard to the amount of sunshine with which we were favoured; and an account of the distribution of this element of our climate during the year may not be without interest. But in attempting this task we meet with an initial difficulty in the comparatively small amount of instrumental data available for the purpose, and in the unequal apportionment of the data we do possess to different portions of the country. Although a sunshine recorder is now getting to be regarded as a necessary item in the equipment of a meteorological station, there is still a large number of observers who do not possess one, and in consequence there are quite large areas of the country which, so far as their sunshine capabilities are concerned, are wholly unrepresented.

In some districts, however, sunshine recorders are fairly numerous, and for such regions the distribution of bright sunshine can be summarised with considerable accuracy; but for the less favoured, though probably not less important, districts, where the instruments are few and widely apart, the deductions drawn from the available data can only be regarded as more or less close approximations to the truth.

For the present brief discussion of the sunshine of 1906 the data employed have been derived from one hundred recorders of the Campbell-Stokes (burning) pattern, distributed over the British Isles from the Orkneys to the Channel Islands, and from the coast of Norfolk to that of Kerry. The number is obviously too small to represent fully so large an area, but it is, I believe, the largest which has hitherto been available for any similar purpose.

The data have been dealt with in two ways—one being to use the number of hours of bright sunshine actually registered, and the other to take into consideration the possibilities of the station, as regards its geographical position and the season of the year, and then express the number of hours recorded as a percentage of the total number

possible, supposing the sun to shine without interruption from sunrise to sunset; purely local conditions by which the horizon of the recorder may have been curtailed have not been taken into consideration.

Dealing first with the aggregate number of hours recorded in the year, the distribution—not the actual number—over the kingdom followed pretty closely that of an average year, the largest totals being found at the coast stations, and the *isohels*, or lines of equal duration, showing a marked tendency to follow the trend of the coast, as indicated on the accompanying map. The most favoured region was the English Channel and its junction with the North Sea, 2000 hours being approximately the amount recorded at every station along the coast from Torquay to Lowestoft. Inland the amount became less, but still the whole of the region south of a line drawn from the Humber to the Bristol Channel received, broadly speaking, over 200 hours more than its average yearly amount of sunshine. The smallest aggregate was that received by the north-western portion of Scotland, where it fell below 1200 hours, an amount which does not differ greatly from the average for that region. Regarding the results for the year in another way, there were 22 weeks in which the south of England was favoured with more than the average duration of sunshine; as many in which the amount was normal; and only 8 weeks in which there was a deficiency. Over the north-eastern portion of England, which also was a very sunny region last year, there were no fewer than 27 weeks with more than average sunshine, and only 9 with less than the average; while the north of Scotland had only 15 weeks which were relatively sunny.

Coming now to the individual months; the two which were least sunny, relatively to their possible amounts, were *May* and *November*, in both of which months the total number of hours recorded was nearly everywhere considerably below the average. These months, however, were exceptional, and in no other month was there such a general falling off in the records. The most brilliant months were—*February*, when many places, especially those in the north, received nearly 40 per cent. of their possible amounts; *April*, when the average amount was exceeded everywhere, the percentage of the possible amount rising at Falmouth to 66, whilst the recorded totals exceeded 250 hours at many places; and *June*, *July* and *September*, which were also exceptionally sunny months, especially the last named, when not only were the totals relatively larger, but the average amounts were also more generally exceeded than in the two earlier months. During the remaining five months of the year the departures from the averages were less regular, but in each case the southern and south-eastern districts were again well off for sunshine, whilst the north-western and south-western districts, as well as the more northern and western, received only a little above, and sometimes indeed considerably below, their average amounts.

Our space will not admit of much being said as to the correlation

of the amount of sunshine with the other meteorological factors of our climate. Of course the sunshine results are primarily related to the system of wind circulation which prevailed and brought with it, especially to the southern half of the kingdom, the clear skies which made the bright sunshine possible; in their turn the winds were controlled by the prevailing types of pressure distribution. In the two months of low sunshine records the pressure was lower than the average, and the weather was disturbed and unsettled, numerous depressions passing over or near our Islands. High pressure accompanied the fine weather of April, June and September, with their large records of sunshine; and nearly normal pressure conditions prevailed in the other months of the year, but with occasional spells of anticyclonic weather accompanied by light winds and less than the usual amount of cloud.

THE RAINFALL OF 1906.

METEOROLOGICALLY, the outstanding feature of 1906 was the remarkable abundance of sunshine; the rainfall was on the whole of little interest, though many of the details are deserving of the study which in due time they will receive. The concluding columns of the Rainfall Table on p. 241, summarise the rainfall of the year as compared with the 30 years' average used in these pages. The limited number of stations dealt with in the Table prevents us from speaking definitely as to the wetness of the year at so early a date, but the provisional deductions are confirmed by a necessarily incomplete comparison with the very large number of returns already sent in for *British Rainfall, 1906*. If the average rainfall in each case is taken as 100, the general rainfall for England and Wales in 1906 comes out as 100, or exactly the average; that for Scotland as 109, or 9 per cent. above the average; and that for Ireland 96, or 4 per cent. below the average. Viewing the British Isles as a whole, the figure is 101, or an excess of 1 per cent., so that we cannot be far wrong in speaking of 1906 as an average year with respect to the total amount of rain. The driest station which has so far been observed is Ross in Herefordshire, with a deficiency of 25 per cent.; the wettest is Dunrobin in Sutherland, with an excess of 31 per cent. Very few stations showed such great extremes, and the general distribution of rain over the country may be described as follows:—

A dry belt stretched across the centre of England from the East Riding of Yorkshire to South Devon, and a branch from it extended eastward down the Thames valley into Kent. A small patch on the north-west coast of England, and another round the Firth of Tay, were also dry, and the whole of Ireland, except the west and north-west. The only district in Great Britain, however, in which there was anything like a serious deficiency, was a narrow strip running from South Devon to near Derby, and including the middle valley of the

Severn. Here the rainfall was less than 90 per cent. of the average, and at Ross it was only 75 per cent. A deficiency of more than 10 per cent. prevailed over the south-east of Ireland.

The regions with excessive rainfall, exceeding 10 per cent., included a patch in the east of Norfolk, another in the extreme north of Scotland, where Dunrobin had an excess of 31 per cent., and a long narrow area in the centre of Great Britain, including the Pennine range in eastern Lancashire, and the west of the West Riding of Yorkshire, and extending north-westward across the Southern Uplands of Scotland and the Firth of Clyde to the shores of the Firth of Lorne. In the west and north of Ireland small wet patches also occurred.

Had the sequence of two dry years followed by a wet year held good, as it did for the previous fifteen years, 1906 should have been wet. The more detailed discussion of the data which will appear in *British Rainfall* may possibly show that the general rainfall of the country was decidedly above the average, but at present we must suspend our opinion on the matter.

THE CHRISTMAS SNOWSTORMS OF 1906.

IN view of the widespread nature of the snowstorms which formed so marked a feature of the past Christmas, and which occupied so largely the attention of the Press during the holiday season, opportunity was taken of asking the whole of the observers of the British Rainfall Organization to supply information as to their character in their individual localities. The liberal response with which this request was met has had the effect of embarrassing us, for the time at least, with a somewhat unmanageable mass of raw material, rich in promise for future investigation, but from which it is difficult at so short notice to extract more than a few generalities.

As early as December 23rd the prevailing high atmospheric pressure over the British Isles began to give way, and by the following day a brisk fall of the barometer was taking place over the north of Scotland. On the evening of the same day a well-defined cyclonic system located itself over the south of Norway, and subsequently increased greatly in depth and gradient. The temperature, which had risen slightly on the 24th, now fell almost everywhere, and frosts were recorded on the 25th and 26th in most parts of Great Britain. On the evening of the 25th a secondary depression became evident over the north-west of Ireland, and later another large system formed with its centre over the Strait of Dover. The conditions were thus favourable for cold north-westerly winds, of considerable force over the North Sea, and decreasing to the westward.

Snow began to fall generally during the evening of the 25th, or early morning of 26th, and in England the greater part was deposited during this night. In some parts of our Islands, however, heavy

falls took place during the following four days, and for the present purpose it is found expedient to discuss the total depth from 26th to 30th as a whole.

During this period the whole of the British Isles, with some trifling exceptions in south Dorset and on the coasts of the Bristol Channel, was visited with snowfalls of more or less severity. Indeed, the districts in which less than an inch fell were almost negligible, being confined to south-east Wales, part of Wessex, some places in the south and east of Ireland, and also a tract between Edinburgh and Glasgow. Considerably more than half the Kingdom received a fall greater than five inches in depth, the most important exceptions being the whole of England south-west of an irregular line crossing the country from the Solway Firth to Brighton, except some patches in the upper Thames Valley. A somewhat lighter fall also took place in south-east Yorkshire, Bedfordshire, and parts of Essex. The north and central uplands of Wales probably exceeded the five-inch limit, although insufficient data make it unsafe to speak definitely of the remoter districts of the Principality. In East Anglia a large and fairly well-defined area, including most of the south of Norfolk and the north of Suffolk, lay under snow exceeding ten inches in depth, and as much as fourteen inches was reported from Wymondham. More than ten inches fell over the northern extremity of the Chilterns, but this was confined to a quite small area. Between Lincoln and Newark also, nearly a foot undoubtedly fell. The part of England, however, which suffered most severely was a strip including the more elevated portions of the county of Durham, and stretching along the east coast of Northumberland into the southern uplands of Scotland. Eighteen inches fell near Morpeth, and probably about a foot over the upper valleys of the Tees and Wear. About the same amount is reported from Berwickshire and Peeblesshire. The basins of the Clyde and Forth, together with large tracts in southern Perthshire and Argyll, escaped comparatively lightly, but to the north of this there seems to have fallen almost everywhere a covering of a foot in depth, reaching upwards of two feet in Kincardine and probably also in southern Aberdeenshire. A strip with less than five inches however occurred round the shores of the Moray Firth.

Although the greatest depth recorded was undoubtedly in Scotland, the extent and severity of the storm in Ireland was certainly more noteworthy owing to the usual immunity of the Emerald Isle from heavy snowfalls. More scattered information than exists for Great Britain render positive assertions unsafe, but as far as the data can be relied upon to represent the facts, the whole island north of the latitude of Dublin, apart from the sea borders, received above five inches, an instance of widespread deep snow probably almost unique for Ireland. More than a foot is also reported from several stations in the north and west, and it seems probable that this amount fell over large districts. It is interesting to note the

coincidence of the most affected part of Ireland, with the small secondary barometric depression which formed in this locality, and during the influence of which the greater part of the fall seems to have taken place.

The severity of the storm occasioned much suffering in many localities. Numerous deaths from exposure have been reported; trains were snowed up in the south of Scotland, and for three days Aberdeen was isolated by blocked railways and broken telegraph wires. The most serious disaster was a railway collision near Arbroath, attended by much loss of life.

ATMOSPHERIC PHENOMENA DURING THE CHILE EARTHQUAKE.

By WILLIAM GAW, Santiago.

IN view of the interest occasioned by the terrible earthquake which visited the central part of Chile on August 16th, I bring forward some data relative to the atmospheric phenomena observed in Santiago just before and after the seismic movements. I may here advert to the fact that the Meteorological Section of the Chilian Navy in Valparaiso, about seven days previous to the catastrophe, prognosticated some atmospheric or seismic disturbances for that day in the following terms, translated from the local newspapers:—

The Meteorological Section of the Direction of Marine Territory has prognosticated atmospheric or seismic phenomena for the 16th of the present month, based on the following observations:—

On the said day there will be a conjunction of Jupiter with the Moon and maximum of northerly declination of the Moon. Owing to these positions of the planets the circumference of the dangerous circle passes Valparaiso.

The above prediction naturally arrested my attention, although I confess I was rather sceptical as to any seismic disturbances being produced by the conjunction of Jupiter with the Moon. The forecast was virtually ignored by the general public, who take little or no interest in atmospheric phenomena, the only living interest taken in these matters being found amongst the officers and officials of the Chilian Navy.

Santiago Observatory is situated in latitude $33^{\circ} 26' 42''$ South, longitude $70^{\circ} 41' 36''$ West of Greenwich, at an altitude of 1706 feet above sea level. The mean annual barometric pressure for Santiago is 28.23 inches.

The following table is issued by the Astronomical Observatory as an approximate guide for weather forecasts in Santiago:—

	inches.
Good weather fixed	28.60
Good weather	28.41
Variable	28.23
Rain	28.05
Storm	27.87
Hurricane	27.70

The comparatively small range between the minimum (27.70 in.) and the maximum (28.60 in.) of the barometric fluctuations is worthy of remark, but, as is well known, the oscillations in high latitudes are much greater than those near the tropics. The greatest monthly variation recorded since 1860 was .60 in., in June, 1903. A monthly variation of .44 in. is abnormal and very rare. The total variation since 1860 has been .90 in. (August, 1865, 28.67 in., and June, 1905, 27.77 in.)

Bearing in mind the forecast for August 16th, we carefully watched the movements of the barometer, hygrometer and thermometer, with the object of detecting anything which might indicate the fulfilment of the prediction issued by the Meteorological Office in Valparaiso. The first sign of anything unusual was on the evening of the 11th, at 9 p.m., when rain began to fall and continued during the following day up to 4 p.m. The amount of rain during these 19 hours was 1.97 in. The prevailing wind was from the N., with a maximum velocity of 30 miles per hour. On the 12th nothing in the weather attracted attention. On the 13th we had a S.W. wind blowing all day, accompanied by a very high barometer. The following are the readings for that day and the days following:—

	1906. AUG. 13.		AUG. 14.		AUG. 15.		AUG. 17.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Temp. (shade).	41°·2	48°·0	32°·9	48°·6	44°·1	52°·9	45°·3	57°·4
„ (exposed).	41°·0	59°·0	28°·4	47°·3	30°·2	54°·5	44°·2	79°·7
Bar. (inches)...	28·30	28·52	28·40	28·52	28·08	28·38	28·36	28·37
Rel. Humidity	76%	95%	52%	99%	84%	97%	65%	95%

Notwithstanding the conditions on the 13th, we had that day heavy showers of rain. This infrequent phenomenon courted special mention in the readings issued by the Astronomical Observatory in Santiago. A similar phenomenon was observed on the 14th—*i.e.*, high barometer accompanied with rain.

A decided change in the barometric pressure took place on the 15th, as shown in the foregoing table. There was a very pronounced drop of the barometer within 24 hours, something very unusual for Santiago. On the 16th, Valparaiso, Santiago and surrounding districts were visited by a terrible earthquake, causing enormous loss of life and property in the former city. As no meteorological readings for the 16th were published I am unable to furnish figures. The first shock came at 7 h. 58 m. 44 s. p.m., without any previous warning, and continued till 8 h. 3 m. 34 s.; direction N. to S., duration 4 m. 50 s. This was immediately followed by another shock at 8 h. 7 m. 30 s. with 20 minutes' duration. The latter shock was the severest and most destructive of all. Up to 5 a.m. the following day we experienced 23 shocks at different intervals. Copious rain fell for some hours before the first shock and continued until about 10 p.m. At the time of writing (October 20th) 106 shocks have been recorded by the seismograph in Santiago. At the moment of the catastrophe the heavens presented a most unnatural hue.

Electrical discharges were numerous, and it seemed as if the sober laws of physics had revolted. The writer cannot recall with precision the exact atmospheric conditions prevailing at the moment of the great disturbance, though he has more than a vivid recollection of that never-to-be-forgotten night. On the 17th, as shown in the Table, the atmospheric conditions appeared to be more or less normal once more. The subsequent readings showed nothing unusual except that they were marked by high barometric pressure until the 21st.

From the data brought forward we deduce the following :—

(1) The third and second days previous to the great shocks were characterised by a high barometer accompanied with rain—abnormal conditions here. (2) The day preceding the first seismic movement (15th) was marked by a sudden fall of about half-an-inch of barometric pressure in a comparatively short period of time.

The cause and import of such a fluctuation is perhaps difficult to determine, but the writer is of opinion that there was some relation between the earthquake of the 16th and the atmospheric phenomena observed before and after it. He is also convinced that there is interesting and instructive information to be acquired by carefully observing all atmospheric phenomena that precede seismic movements all over the globe. That there is *some* relation between atmospheric perturbations and seismic tremors few will deny ; and it may not be too much to anticipate that in future observers in meteorology will play their part in contributing data that will help to determine the genesis of seismic phenomena. Until we possess a more perfect knowledge of the physical conditions existing a few miles beneath the Earth's crust we should be content to be tentative and not dogmatic in our assertions. Statements emanating from such authorities as Professor J. Milne and the Hon. R. J. Strutt are pregnant with deep import and open up unlimited fields of research to the intelligent observer.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held at the Institution of Civil Engineers, Great George Street, Westminster, on Wednesday evening, December 19th, Mr. Richard Bentley, President, in the chair.

Admiral J. P. Maclear read a paper on "The Guildford Storm of August 2nd, 1906." This storm showed some very curious and interesting features, in the remarkable violence of the wind, rain and hail, within a small area, and the suddenness with which it burst. There was an area of thunderstorms over the whole of the south of England on the evening of that day. The most violent storm, however, burst over Grayshott on Hindhead at 8.20 p.m., and pursued a narrow track through Godalming and Guildford to

Ripley, five miles north-east of Guildford. The wind was of hurricane force, and blew down an immense number of trees and caused other damage and also the loss of two lives. The rain, accompanied by large hailstones, was very heavy, as much as 1.17 in. falling at Grayshott in 15 minutes. There was a magnificent display of lightning, the flashes being incessant and darting from cloud to cloud. The observer at Charterhouse School, Godalming, gave the following interesting account, which shows the intense character of the storm:—

“At about 8.35 a few splotches of rain, a roar of the whirlwind, and then such hail and rain as I had never witnessed before, and trust may never again; the noise was deafening, as though hundreds of loads of gravel were being shot from on high against the window panes, while all the while the thunder bellowed and crashed overhead. My front door was open when the tornado burst, and I had great difficulty in shutting it; but even in those few moments my hall was flooded, curtains, mats and rugs blown upstairs, and a bucketful of hailstones, as large as sparrow's eggs, deposited at the foot of the stairs.

“In about eight minutes it was all over: the sky resumed its tranquil aspect as though nothing had happened, and the storm rolled quickly away to the north-east. The barograph in the library showed at the onset of the storm, at 8.35, a jump of $\frac{1}{2}$ of an inch, and immediately a fall of $\frac{3}{20}$, then gave a slight ‘kick’ and a steady rise. The rainfall during the eight minutes was .77 in., though there was probably rather more, as hailstones often jump out of the funnel of the rain gauge.

“The region of maximum violence in our neighbourhood was undoubtedly from Hurtmore Bottom to Guildford. The breadth of the disturbance was about 2 miles; its north-west boundary lay between Priors Field and Puttenham, probably nearer the former, for Shackleford escaped serious damage.”

An interesting discussion followed the reading of this paper. Dr. Theodore Williams referred to the damage done to the trees in his immediate neighbourhood at Witley.

Mr. W. H. Dines said that the storm seemed to have taken a track a little north of the railway from Guildford to Surbiton, ending in the neighbourhood of Oxshott.

Mr. W. Marriott showed some photographs of lightning taken during the storm, and stated that it was reported that in London there were over 600 flashes in 52 minutes. He also referred to the severe hailstorm which occurred on the same evening on the borders of Bedfordshire, Cambridgeshire and Huntingdonshire, where considerable damage was done. He thought that the jump in the barograph trace was largely due to the compression of the air caused by the sudden heavy rainfall.

Mr. R. G. K. Lampfert enquired whether the trees were all blown down the same way. He also stated that he had collected a large

number of records for that day from all parts of the country, but had not been able to get any satisfactory results from them.

Prof. A. S. Herschell described an effect of the lightning on the same evening in the north of England. A large hole was made, and the sod was hurled a distance of 25 yards.

Dr. W. N. Shaw, Mr. F. C. Bayard, Mr. T. P. Newman, Mr. W. B. Tripp, Capt. A. Carpenter, and the President also spoke, and Admiral Maclear replied.

The following were elected Fellows of the Society :—Mr. R. M. Balston, Capt. K. E. Digby, Major G. R. Elliot, Major G. E. Galbraith, Capt. A. A. C. Galloway, Capt. C. G. Manners, Mrs. H. R. Mill, Mr. R. Mond, Major C. Peters, Mr. H. Reid, M.Inst.C.E., Capt. E. J. W. Slade and Mr. W. Wilson.

LIGHTNING CONDUCTORS.

On December 6th, Mr. Alfred Hands delivered a lecture before the Royal Engineers at Chatham, on "The Protection of Buildings from Lightning." He showed the extent of damage by lightning by means of a chart of England and Wales, on which the positions and nature of objects damaged during a period of about nine years were indicated by coloured spots. This included 2,485 buildings, of which 148 were churches. He criticised the Report of the Lightning Research Committee, which, he said, by its contradictory recommendations and incorrect statistics, had caused a great deal of scepticism as to the utility of lightning conductors. He showed by diagrams and reproductions on models of buildings of cases that had occurred, some of the more complex lightning effects that had to be guarded against, and the methods of protection that had to be employed. These included fires caused by the surging effect of a discharge, and cases in which damage is caused to a building by lightning striking an object half a mile away.

The lecturer showed the impossibility of protecting buildings efficiently by means of set rules; each case had to be studied separately, and the system of protection applied which the complications of metal in and about the structure showed to be necessary. Hitherto too much importance had been attached to the form and composition of the conductor, and too little to the fact that its efficiency depended almost entirely on the way in which it was applied, and very little on what it was. He regarded the subject as somewhat analogous to the work of a medical practitioner. The conductors in the hands of an expert were comparable to the drugs a physician might find it necessary to prescribe according to his diagnosis of the case. No one could claim infallibility, and anyone might overlook some factor that might have an important bearing on the case; but the fact remained that the possession of knowledge, experience, and an ability to discriminate as to the importance of details should enable a man

to protect a building effectively, while absence of these would very probably result in failure. At all events, it was in this direction he thought we should strive to improve our methods, and not in trying to devise theoretically perfect, but practically impossible mechanical arrangements.

As regards the relative value of iron and copper for conductors, he considered the matter so far as concerned conductivity and the dissipation of energy, to be of such trifling importance that it sank into insignificance in comparison with considerations of durability. A lightning conductor was expected to last for a long time, and iron was, unfortunately, too perishable for the purpose. As regards cost, an iron system, if of sufficient size to be fairly lasting, would be more costly than an ordinary copper tape one.

Mr. Hands said that vagaries or freaks of lightning were an impossibility, and the belief in such was due only to the cases being wrongly reported. There were laws governing all natural phenomena, and lightning, like every other force in Nature, must be amenable to law. Where they appeared at first sight inexplicable, we should try to clear up the mystery, and not dismiss the matter by saying that in one respect Nature was erratic.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

AUDIBLE METEORS.

THERE is no need for you to apologise for having placed a ? after the title of Mr. Huntley's letter on p. 190 of the November number ; he himself evidently considers that any connection between the sound and the meteor is doubtful, and he may well do so. Mr. Wood, on the other hand, sees no difficulty in the connection, and cites several instances to show that meteors emit sound. There is no doubt they do, but I would point out that these cases do not explain Mr. Huntley's observation.

In the instances of the great Madrid meteor and the meteor of January 25th, 1894, 10 p.m., a distinct time interval between the flash and the detonation was recorded, in no case probably less than one minute.

In the instance of January 9th, 1900, there is no mention of what the time interval was. In the instance of November 20th, 1887, the meteor was seen only at Hertford, and it is expressly stated that no report was heard there. All other observations deal with the sound only, and therefore no time interval could be recorded.

But in Mr. Huntley's case he heard the sound *before* he saw the meteor. I would ask Mr. Wood how he explains this, except on the supposition that the velocity of the meteor was less than that of

sound; and, if so, how at such a velocity could the meteor be incandescent?

Many instances of similar observations have been recorded. The only probable explanation is that the observer, startled by the suddenness of the phenomenon, unconsciously attributes to the meteor the hissing sound with which in the case of a rocket he is doubtless quite familiar.

In Vol. XIII., p. 277 of the *British Astronomical Association Journal*, there is a most interesting letter from Mr. Denning on this subject. No one knows more about meteoric astronomy than he does, and with your permission I append a few extracts:—

"I have seen some thousands of meteors of various magnitudes and kinds, but never in a single instance detected any hissing or rushing sound attending an object."

"The attention of an observer at Faringdon, Berks, was attracted by a distant hissing sound, and looking up he saw the meteor. Another observer at Bath distinctly heard a slight continued hissing. The observer in Berks was 150 miles distant from the meteor."

"A number of the observers, who have confidently affirmed that sounds were audible simultaneously with meteoric outbursts, were distant 100 or 150 miles from the objects, whereas other observers much nearer to them say that the flights were absolutely silent."

The only case (quoted in the same letter) of an experienced observer hearing a sound is that of Lieut.-Col. Tupman, who, when at anchor in the River Plate, "saw a shooting star of the first magnitude traverse some 40° of the sky, and less than a second after heard a gentle hissing sound from its direction, which greatly astonished him." Mr. Denning then adds: "He merely reported the observation as a curious incident, without attaching undue importance to it."

CHARLES L. BROOK.

Harewood Lodge, Meltham, Dec. 27th, 1906.

THE SUNSPOT QUESTION.

ACCORDING to a review in your November issue, Prof. Bigelow represents that when the sun is most active, and spotted, temperature is relatively high in the tropics and low in temperate regions. As this appears to be in conflict with facts established by Köppen and Nordmann for the tropics, and with our own experience in these parts (Greenwich), some explanation will be acceptable. A.B.M.

8, Marine Crescent, Folkestone, 7th Dec., 1906.

THAT'S WHY.

HEREWITH I enclose answers to the two questions on page 211 of *Symons's Meteorological Magazine*, which are puzzlers to answer concisely.

P. P. PENNANT.

Nantlys, St. Asaph, 26th Dec., 1906.

Why do rain-drops differ so much in size ?

Rain-drops are formed in cooling air. At first extremely small, they touch each other, coalesce, and become larger. Large drops fall faster than small, hence, incessant collisions, producing larger drops. So falling from a great height rain-drops may be large, but formed near the Earth must be small.

P.P.P.

Why is the distant view . . . so remarkably clear before rain ?

Because the air we look through has already been washed with rain, or is so nearly ready to form rain that it has moistened the dust and smoke in the air, making them too heavy to float in the air any longer, and produce haze.

P.P.P.

[Several answers have been received ; but the neatest appears to be the above.—ED. *S.M.M.*]

NATURE'S REVEILLÉE.

A CURIOUS phenomenon reported to me many years ago by a cousin who had a large horse ranch in Colorado, U.S.A., has recently received such satisfactory confirmation through the 7 in. chart of the latest barograph, that I think it worth mentioning to your readers. The phenomenon in question is that Nature causes a curious trembling or shiver of the air over the enormous American plains an hour or so before sunrise, which acts as a *reveillée* call for all the animals, birds and insects to be on duty for the rising sun. This would appear to be a very beautiful provision of Nature, and although we, with our heavy dock traffic, cannot say whether there is a tremor in the air attributable or not to the atmosphere, the new 7 in. barograph shows that there is a small V-shaped depression occurring each morning about 90 minutes before sunrise—a sort of *reveillée* dip, in fact—the extra 30 minutes being due probably to our more northern situation.

If those possessing these new instruments will kindly direct their attention to this question they may be able to favour us with some valuable data.

J. H. W. BIGGS.

Liverpool, November 20th, 1906.

[The regular diurnal variation in atmospheric pressure in and near the tropics is so persistent that it is not unreasonable to suppose that at the period of temperature minimum shortly before the dawn some slight air movement may occur every morning ; but we doubt whether any such occurrence could be traced amidst the irregular changes in the unstable atmospheric equilibrium of our latitudes. We should require a much more definite statement than Mr. Biggs supplies before accepting the existence of so highly improbable a phenomenon.—ED. *S.M.M.*]

THE GREEN FLASH.

As the discussion of this phenomenon has excited considerable interest of late, I am sending you particulars of its appearance in, so far as I know, exceptional circumstances. On the 23rd of December, when using a pair of opera glasses, I watched the sun setting into a low and narrow cloud stretching along the south-western horizon. The cloud was scarcely apparent to the naked eye, but plainly visible through the glasses, whilst the whole of the disc was visible, and just as the bottom edge touched the cloud, there was a beautiful green lining along the top edge, deeper at the middle than at the two extremities. This slowly diminished until it disappeared. After a few seconds it re-appeared, but not so strongly as before, and again diminished to nothing when the sun's disc was about two-thirds hidden, and was not seen again. The sun was redder at the bottom than at the top, and I saw no prismatic colours.

Does not this point to the green flash being produced through a peculiar condition of the atmosphere favouring its appearance rather than from some of the causes which have been adduced to account for it?

I may mention that I have seen both a green and blue flash on several mornings during this month through a three-inch refractor when the sun has risen out of a bank of clouds stretching along the sea horizon. The appearance, however, was not in the nature of a flash (except in its rather sudden disappearance), as I watched it on each occasion for several seconds as the green or blue colour travelled along the opposite edges of the cloud as more and more of the sun's disc became visible. The eye-piece was a magnifier of about 60 diameters, and the image of the cloud and arc of the sun's disc were, of course, inverted.

WILSON LLOYD FOX.

Falmouth, 26th December, 1906.

SINCE you published Admiral Maclear's letter about a year ago (*Symons's Meteorological Magazine*, January, 1906, p. 227) on the subject of the green flash, your correspondents have, it seems to me, described four or five different phenomena under this name.

1. In order to see a striking phenomenon, which may be described as a green flash, the observer has only to look for a second or so at the red disc of the rising or setting sun, and then to alter slightly the direction of his eyes, and he will immediately see a visionary image or spectrum of the sun in the complementary green colour. If the disc of the sun happens to be coloured orange, the visionary image will be blue. This is an example of ordinary successive contrast, and is a physiological phenomenon. There is no reason why it should not be just as well seen at sunrise as at sunset.

Last summer there were some beds of *calceolarias* in the flower

garden under my bedroom window. On getting up in the morning and opening the shutters I could hardly avoid looking on one or another of these beds. My eyes, after sleep, being thoroughly rested, and therefore susceptible, a momentary glance at the flowers was sufficient to stimulate my eyes, as soon as their direction was slightly altered, to produce visionary images of the flowers in the complementary blue colour. They were seen as blue spots on the turf near the flowers, lasted about a second, and might be described as "blue flashes."

I may add here that I do not consider their appearance to be due to "fatigue" of the eye, but to its vital elasticity, which produces out of itself the colour or colours necessary to complete the triad of leading colours. Thus the green demanded by red contains yellow and blue; orange, uniting yellow and red, demands blue; and the violet demanded by yellow contains red and blue.

2. I have not myself witnessed the green flash described by Admiral Maclear and other observers as seen when the sun is rising above or sinking below a sea horizon in a clear sky.

When the sun at rising or setting is coloured red or orange, this green flash may be an example of the physiological phenomenon of colour described above. Or it may be a phenomenon produced by coloured shadows. Coloured shadows are seen when there are two lights in the atmosphere, one coloured and the other uncoloured.

The shadow cast by the coloured light (in this case red) and illumined by the uncoloured one, would exhibit the complementary colour (in this case green).

The phenomena of coloured shadows, although belonging to the physiological colours, have more objective reality than the previously described examples of physiological contrast. Again, it is possible that this example of the green flash may be produced by the intermixture of a yellow ray of the rising or setting sun with the blue of the sky.

As the green flash is seen when the sun is rising above or setting below the edge of the horizon, it may be produced by *refraction*, or by *diffraction*, or by both combined. If produced in this way, the stripes of colour accompanying the refraction or diffraction may, when pressed together just before their disappearance, produce a greenish-blue or a red colour, which may be described as a greenish-blue or as a red flash.

In the first two cases the phenomena would be examples of physiological colours; in the last two, of physical colours.

3. The phenomena described in the latter part of Prof. Michie Smith's letter in *Symons's Meteorological Magazine*, June, 1906, p. 91, appear to be examples of physiological colours due to contrast.

They are examples of *simultaneous* contrast, while the phenomenon first described is due to *successive* contrast.

In the first case, the upper part of the sun's disc, when it was setting, and when its light was probably subdued by haze or mist,

was coloured green, because the reddish light reflected by the clouds evoked the complementary green colour. In the second case, the green mist which filled the whole sky at sunset, was probably due to the same cause.

The green colour in both cases was the complementary colour of the reddish light reflected by the clouds, and was an example of *simultaneous contrast*.

If a piece of white paper is placed on a red surface, the white paper will be tinged with a green hue.

4. The phenomenon seen through a telescope, and described by Dr. Rambaut (*Symons's Meteorological Magazine*, March, 1906, pp. 21-23, and April, 1906, pp. 41-45), and by Mr. Whitmell (December, 1906, pp. 209-210), are, of course, examples of the colours which accompany refraction.

Mr. Whitmell describes how the yellow border at the base of the sun widens out, and meeting the blue edge at the top of the disc, produces green. This green he calls a green flash.

5. In the observations described by Mr. Whitmell, and quoted by Dr. Rambaut as seen through the narrow openings in a belfry; in the observations described by Dr. Rambaut as seen through a telescope, in which an opaque diaphragm, or a diaphragm with a narrow slit, had been placed; and in the observations described by Mr. Whitmell (December, 1906, p. 209), when "the sun was sinking behind a low horizontal narrow bank of cloud, between which and the horizon was a strip of clear sky," the colours seen are due to refraction and diffraction.

I have tried to separate the different phenomena, which have been described under the name of the "green flash," into different classes, according to the conditions under which they are produced.

Some of the phenomena are due to *successive contrast*, some to *simultaneous contrast*, some may be examples of the phenomena produced by *coloured shadows*.

Others, again, are examples of the colours which accompany *refraction* only, or both *refraction* and *diffraction*.

Again, a green flash might be produced by the admixture of a yellow ray of the rising or setting sun with the blue of the sky.

The three first cases belong to the class of the physiological colours; the three last to that of the physical colours.

Admiral Maclear remarks (January, 1906, p. 227) that different "writers appear to hold different views as to the cause" of the "green flash." The reason, as it seems to me, is that the writers are describing *different* phenomena under this name; phenomena which are produced by different conditions, and are to be traced to different causes.

R. C. CANN LIPPINCOTT.

Over Court, Almondsbury, Bristol, 3rd Jan., 1907.

[Our great respect for Mr. Cann Lippincott as an earnest and enthusiastic meteorological observer, makes us desirous of showing

him every possible courtesy, and we have enlarged this number of the Magazine in order to admit his letter, which our editorial conscience feels is too long. We do not agree with his views on the question of colour, but most fully support Dr. Rambaut's able and convincing demonstration of the phenomenon under consideration, which no correspondent, so far as we are aware, has confused with the familiar effects of complementary colours except Mr. Lippincott himself. When he sees the phenomenon which our correspondents have described he will, we believe, at once recognise its essentially distinct character. The Green Flash has illuminated our pages for a year, and we do not propose that the correspondence should continue.

ED. S.M.M.]

REVIEWS.

The Science Year Book, with Astronomical, Physical and Chemical Tables, Summary of Progress in Science, Directory, Biographies and Diary for 1907 (third year of issue). Edited by Major B. F. S. BADEN-POWELL. London, King, Sell & Olding. Price 5s. net. Size $9\frac{1}{2} \times 6$. Pp. 152 + diary.

THIS very conveniently arranged book is particularly useful to the student of Nature who interests himself in various branches of science. The introductory matter is well planned, and every here and there one comes on little tables of a useful kind that it would not be easy to find elsewhere. The diary gives for each day the hour of the rising and setting of the sun and moon, and of such planets as are visible, a note of the constellations which are on the meridian at midnight, a memorandum of the maximum and minimum temperature for the day at Greenwich, and spaces for the meteorological observations of the day.

The Life-History of Surface-Air-Currents. A Study of the Surface Trajectories of moving air. By W. N. SHAW, Sc.D., F.R.S. (Director of the Meteorological Office) and R. G. K. LEMPFERT, M.A. Published by the Authority of the Meteorological Committee, London, 1906. Size $12\frac{1}{2} \times 10$. Pp. 108. Price 7s. 6d.

INFALLIBILITY is one of the most cherished prerogatives of an Editor, and the acknowledgment of any shortcoming is so unusual a proceeding that we only make it when fairly cornered between the Devil of accumulated literature and the Deep Sea of a new year teeming it may be with as good fish as ever came out of the old. We meant well in the way of reviews for 1906, and particularly we resolved to devote abundant space to any important contributions to Meteorology

published in Great Britain. Now we find ourselves looking helplessly at what we believe to be the most important contribution to meteorology of 1906 produced in any country, and the very importance of the work makes it at once an impossibility to give an adequate review in the space and time at our disposal, and an impertinence to offer an inadequate one.

We therefore attempt no review, but only say that the method employed in this memoir is that of tracing the actual path of the air as it takes part in a travelling storm, and the results though now seen to be in accordance with the laws of air-movements, are such as had not been anticipated before Dr. Shaw and Mr. Lempfert originated the promising method of research here laid down. We need not urge the serious student of meteorology to read the "Life-History"; he will recognise that it is essential if he wishes to keep in touch with what may be termed the "growing point" of the science.

Popular Meteorological Handbook. Some Facts about the Weather by WILLIAM MARRIOTT, F.R.Met.Soc., Assistant Secretary. London: Edward Stanford. 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$. Pp. 32. Price 6d.

THIS pamphlet is designed to give in a brief and popular form such fundamental facts about the weather as should help the "man in the street" to understand the references in his newspaper, and whet the interest of the amateur observer to seek fuller information elsewhere. There is no one better able than Mr. Marriott to appreciate the points regarding which information is most welcomed by the public interested in weather, nor is there a more experienced or safer guide than he in all that pertains to practical observing. The service he is rendering to his Society as a popular lecturer on various aspects of weather-lore is no small one, giving expression as it does to the experience of a lifetime spent in the Society as assistant-secretary and inspector of stations. It is to be hoped that this little book will widen the interest in the work of the Royal Meteorological Society, and be the means of introducing many to the privileges which the Society offers.

Der meteorologische Äquator im Stillen Ozean, von R. WESTERMANN. Aus dem Archiv der Deutschen Seewarte. 29 Jahrgang 1906. No. 1. Hamburg, 1906.

THIS paper discusses the position of the meteorological equator in the Pacific Ocean with regard to such elements as temperature, humidity, wind-force, precipitation, cloudiness and pressure distribution. The meteorological equator is theoretically defined as the imaginary line which connects places along each meridian with the highest mean annual temperature, and which represents a division of

areas corresponding to an approximately symmetrical distribution of the various meteorological elements. From this line towards either side the mean air pressure and wind velocity increase, the mean cloudiness, humidity and amount of precipitation decrease, and the mean wind direction indicates the exact component due to the position of the wind along a meridian. With regard to the Pacific Ocean, some of the material under discussion has been derived from six hundred meteorological logs kept on sailing vessels, and from certain land stations mainly in the islands under German protection. The thermal equator is the bisector of a temperature belt bounded by the isotherm of 25° C., which alters its breadth and latitude according to the time of year. In the eastern half of the ocean the form of the belt is affected by the South Equatorial Current, which shifts and compresses the belt towards the north, but in the western half of the ocean its breadth is not hampered. In the summer half-year of the northern hemisphere, however, owing to its northward trend, the belt is little influenced by the South Equatorial Current. Much information in figures relating to the meteorology of the Pacific Ocean is given in tabular form in the paper under our notice.

L. C. W. B.

METEOROLOGICAL NEWS AND NOTES.

PROFESSOR H. H. HILDEBRANDSSON has resigned the office of Director of the Meteorological Observatory at Upsala, and Mr. F. Aakerblom is discharging *ad interim* the duties of the Director.

THE MACHRIHANISH TOWER, the fall of which during the gale of December 5th, 1906, was described by Mr. Douglas in our last issue (p. 201), was constructed, according to a well-informed local correspondent, of lengths of steel tube which did not overlap but were rivetted together through flanges. The immediate cause of the catastrophe was the drawing of the ends of the wire cables out of the masses of soft metal in which they had been embedded, and not any defect in the material employed.

MR. W. MARRIOTT has arranged to lecture in accordance with the Royal Meteorological Society's scheme of local lectures on February 6th at the British Sea-Angler's Society, Fetter Lane, London, E.C.; on February 9th at the Ealing Scientific and Microscopical Society; on February 18th to the Glasgow Amateur Photographic Association, and on March 13th at Kendal.

THE AMIR OF AFGHANISTAN deserves to be ranked a meteorological observer. At one of the receptions in India the weather was bad, and *The Times* records that "he bore the discomfort of the weather with the greatest equanimity, remarking that rain was always considered a sign of good fortune in Afghanistan."

TEMPERATURE FOR DECEMBER, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				No. of Nights at or below 32°	
					Max.		Min.		Shade.	Grass.
					°	Date.	°	Date.		
Camden Square.....	London.....	51 32	0 8	111	55.1	3	20.9	27	13	22
Tenterden.....	Kent.....	51 4	*0 41	190	54.0	3	16.0	30	19	23
West Dean.....	Hampshire.....	51 3	1 38	137	53.0	3, 4	19.0	24	17	25
Hartley Wintney.....	".....	51 18	0 53	222	55.0	3, 4	19.0	28	22	24
Hitchin.....	Hertfordshire.....	51 57	0 17	238	53.0	4, 5	19.0	20	21	...
Winslow (Addington).....	Buckinghamsh.	51 58	0 53	309	55.0	4	14.0	27	22	23
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	*0 40	226	52.0	2, 3, 4	13.5	30	...	...
Brundall.....	Norfolk.....	52 37	*1 26	66	...	...	...	...	...	...
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	53.9	3	24.0	24	15	20
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	57.1	4	28.8	28	4	11
Polapit Tamar [Launceston].....	".....	50 40	4 22	315	52.9	3	24.9	29	12	17
Bath.....	Somerset.....	51 23	2 21	67	55.0	3	21.0	30	15	...
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	52.0	2	24.0	29	19	...
Church Stretton (Woolstaston).....	Shropshire.....	52 35	2 48	800	55.0	4	15.0	27	25	...
Bromsgrove (Stoke Reformatory).....	Worcestershire.....	52 19	2 4	225	51.0	5	10.0	26	22	...
Boston.....	Lincolnshire.....	52 58	0 1	25	52.0	2	15.0	27	21	...
Worksop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	54.7	4	13.7	30	18	25
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	52.0	2	18.0	26, 29	20	...
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	52.8	2	19.7	27	19	21
Wetherby (Ribston Hall).....	Yorkshire, W.R.	53 59	1 24	130	...	...	...	...	...	...
Arneliffe Vicarage.....	".....	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park).....	"..... E.R.	53 45	0 20	6	54.0	2, 5	22.0	30	17	27
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	53.6	4	15.5	27	17	...
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street).....	Pembroke.....	51 48	4 58	95	53.4	2	22.8	23	8	17
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	52.0	2, 4	16.0	28	...	...
Llandudno.....	Carnarvon.....	53 20	3 50	72	54.0	3	28.2	26	6	...
Cargen [Dunfries].....	Kirkcudbright.....	55 2	3 37	80	54.0	2, 17	15.0	26	18	...
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	51.0	2	20.0	22, 30	21	23
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	55.3	2	22.7	26	15	18
Colmonell (Clachanton).....	Ayr.....	55 8	4 54	140	52.0	1, 16	16.0	28	12	...
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	52.0	2, 4	16.0	25	16	24
Tighnabruaich.....	Argyll.....	55 55	5 14	50	50.0	1	19.0	25, 28	19	20
Mull (Quinish).....	".....	56 36	6 13	35	...	...	...	...	...	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	55.0	2	15.5	31	17	...
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford).....	".....	57 8	2 7	120	56.0	2	8.0	29, 30	22	...
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	55.0	4	18.0	31	16	...
Castletown.....	Caitness.....	58 35	3 23	100	52.0	2, 7, 16	11.0	31	17	19
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	57.0	18	16.5	29	...	...
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	56.5	2	22.0	29, 30	11	...
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	50.0	2†	14.0	28	11	...
Carlow (Browne's Hill).....	Carlow.....	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	55.9	5	23.1	30	6	15
Ballinasloe.....	Galway.....	53 20	8 15	160	...	...	...	...	...	...
Clifden (Kylemore House).....	".....	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Ennisecoe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...	...
Seaford.....	Down.....	54 19	5 50	180	52.0	1, 2, 16	20.0	29	14	17
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	53.0	2, 4, 16	18.0	28	13	16

RAINFALL FOR DECEMBER, 1906.

RAINFALL OF MONTH.						RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
Aver. 1870-99.	1906.	Diff. from Av. in.	% of Av.	Max. in 24 hours.	No. of Days	Aver. 1870-99.	1906.	Diff. from Aver. in.	% of Av.		
in.	in.	in.		in. Date.		in.	in.	in.		in.	
2'12	2'21	+ '09	114	'34 25 19		25'16	24'27	- '89	96	25'16	Camden Square
2'74	2'02	- '72	74	'39 25 15		28'36	27'37	- '99	97	28'36	Tenterden
2'74	1'91	- '83	70	'32 15 19		29'93	29'96	+ '03	100	29'93	West Dean
2'55	2'09	- '46	82	'37 25 17		27'10	26'35	- '75	97	27'10	Hartley Wintney
2'05	2'21	+ '16	108	'35 15 18		24'66	25'44	+ '78	103	24'66	Hitchin
2'27	2'20	- '07	104	'38 15 19		26'75	25'73	- 1'02	96	26'75	Addington
2'11	2'46	+ '35	117	'39 25 16		25'39	27'11	+ 1'72	107	25'39	Westley
2'13	3'73	+ 1'60	175	1'20 23 21		25'40	29'96	+ 4'56	118	25'40	Brundall
4'13	2'68	- 1'45	65	'59 30 16		39'00	39'39	+ '39	107	39'00	Winterbourne Stpltn
3'46	1'53	- 1'93	44	'30 12 18		35'00	28'53	- 6'47	82	35'00	Torquay
4'39	4'55	+ '16	104	'65 15 23		38'85	40'10	+ 1'25	103	38'85	Polapit Tamar
2'76	1'87	- '89	68	'37 25 15		30'75	27'24	- 3'51	89	30'75	Bath
2'48	1'50	- '98	60	'32 15 18		29'85	26'87	- 2'98	90	29'85	Stroud
2'92	2'25	- '67	77	'32 5 20		33'04	29'22	- 3'82	88	33'04	Woolstaston
1'95	1'75	- '20	90	'40 15 13		24'50	23'24	- 1'26	95	24'50	Bromsgrove
1'79	2'31	+ '52	129	'64 25 15		23'30	23'71	+ '41	102	23'30	Boston
2'02	2'53	+ '51	125	'48 4 24		24'70	23'43	- 1'27	95	24'70	Hodsock Priory
2'28	2'10	- '18	92	'44 5 22		26'18	23'83	- 2'35	91	26'18	Derby
4'19	5'90	+ 1'71	141	'61 15 24		42'43	50'54	+ 8'11	119	42'43	Bolton
2'19	2'38	+ '19	109	'38 15 16		26'96	27'93	+ '97	104	26'96	Ribston Hall
6'41	5'12	- 1'29	80	'63 5 22		60'96	67'45	+ 6'49	111	60'96	Arncliffe Vic.
2'36	1'98	- '38	84	'34 15 23		27'02	25'46	- 1'56	94	27'02	Hull
2'64	3'84	+ 1'20	145	1'64 27 21		27'99	30'19	+ 2'20	108	27'99	Newcastle
14'70	11'75	- 2'95	80	1'60 2 21		132'68	130'66	- 2'02	98	132'68	Seathwaite
4'43	2'75	- 1'68	62	'38 25 20		42'81	43'49	+ '68	102	42'81	Cardiff
5'22	4'85	- '37	93	'80 27 23		47'88	50'41	+ 2'53	105	47'88	Haverfordwest
4'49	5'27	+ '78	117	'66 11 23		45'41	47'64	+ 2'23	95	45'41	Gogerdan
2'95	2'49	- '46	84	'36 15 23		30'98	31'57	+ '59	102	30'98	Llandudno
4'68	4'17	- '51	89	'85 5 15		43'43	45'42	+ 1'99	105	43'43	Cargen
3'18	3'06	- '12	96	'61 28 20		33'04	34'68	+ 1'64	105	33'04	Riddell House
...	1'17	...	...	'53 12 12		...	31'24	...	...	...	Edinburgh
4'82	7'10	+ 2'28	147	1'46 11 20		44'85	44'04	- '81	98	44'85	Colmonell
3'53	3'62	+ '09	103	'80 15 16		35'80	40'21	+ 4'41	112	35'80	Glasgow
6'33	7'67	+ 1'34	121	1'80 15 22		57'90	67'94	+ 10'04	117	57'90	Tighnabruach
6'48	6'31	- '17	97	'74 1 14		57'53	54'48	- 3'05	95	57'53	Quinish
2'73	1'70	- 1'03	62	'50 12 26		28'95	26'65	- 2'30	92	28'95	Dundee
3'15	2'20	- '95	73	...	...	36'07	37'33	+ 1'26	103	36'07	Braemar
3'39	4'16	+ '77	123	'93 28 17		33'01	35'63	+ 2'62	108	33'01	Aberdeen
2'53	1'91	- '62	76	'32 26 15		29'37	31'89	+ 2'52	109	29'37	Cawdor
6'67	6'51	- '16	98	1'17 2 18		56'00	60'03	+ 4'03	107	56'00	Invergarry
9'04	9'96	+ '92	110	1'93 2 21		86'50	94'91	+ 8'41	110	86'50	Bèndamph
3'39	3'22	- '17	95	'52 15 19		31'60	41'41	+ 9'81	131	31'60	Dunrobin Castle
...	5'33	...	...	'97 4 25		...	39'80	...	...	...	Castletown
6'64	3'67	- 2'97	55	'42 12 25		58'11	45'08	- 13'03	78	58'11	Killarney
4'31	2'28	- 2'03	53	'59 15 21		39'30	33'21	- 6'09	85	39'30	Waterford
3'37	3'29	- '08	98	'84 14 20		33'47	36'50	+ 3'03	109	33'47	Hurdlestown
3'46	2'28	- 1'18	66	'96 15 19		34'44	27'75	- 6'69	81	34'44	Carlow
2'39	1'81	- '58	76	'37 15 18		27'75	22'81	- 4'94	82	27'75	Dublin
3'63	...	...	...	...	...	37'04	...	...	...	37'04	Ballinasloe
8'99	5'06	- 3'03	66	'86 29 18		80'23	71'10	- 9'13	89	80'23	Kylemore House
5'81	5'69	- '12	98	'65 25 28		50'50	51'11	+ '61	101	50'50	Enniscore
3'64	3'64	- '00	100	'82 15 21		38'61	34'23	- 4'38	89	38'61	Seaforde
4'31	6'88	+ 2'57	160	'74 15 26		41'20	45'35	+ 4'15	110	41'20	Londonderry
3'77	3'40	- '37	90	'57 15 22		37'85	42'40	+ 4'55	112	37'85	Omagh

SUPPLEMENTARY RAINFALL, DECEMBER, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	2.86	XI.	Rhayader, Tyrmynydd	...
"	Ramsgate, West Cliff Villas	2.08	"	Lake Vyrnwy	4.82
"	Hailsham	2.56	"	Llangyhanfal, Plâs Draw	3.83
"	Crowborough, Uckfield Lodge	2.57	"	Criccieth, Talarvor	4.89
"	Osborne, Newbarn Cottage	1.94	"	Llanberis, Pen-y-pass	10.55
"	Emsworth, Redlands	2.00	"	Lligwy	3.93
"	Alton, Ashdell	2.60	"	Douglas, Woodville	5.29
"	Newbury, Welford Park	2.59	XII.	Stoneykirk, Ardwell House	4.95
III.	Harrow Weald, Hill House	2.26	"	Dalry, The Old Garroch	7.72
"	Oxford, Magdalen College	1.67	"	Langholm, Drove Road	4.20
"	Bloxham Grove	1.52	"	Moniaive, Maxwellton House	3.80
"	Pitsford, Sedgebrook	2.49	XIII.	N. Esk Reservoir [Penicuik]	4.60
"	Huntingdon, Brampton	2.80	XIV.	Maybole, Knockdon Farm	3.86
"	Wisbech, Bank House	2.02	XV.	Campbeltown, Witchburn	5.24
IV.	Southend Water Works	1.82	"	Inveraray, Newtown	8.70
"	Colchester, Lexden	2.09	"	Ballachulish House	10.38
"	Newport, The Vicarage	2.89	"	Islay, Eallabus	6.80
"	Rendlesham	2.69	XVI.	Dollar Academy	2.37
"	Swaffham	2.21	"	Loch Leven Sluice	1.67
"	Blakeney	1.98	"	Balquhider, Stronvar	4.91
V.	Bishops Cannings	2.29	"	Perth, Pitcullen House	1.47
"	Ashburton, Druid House	3.48	"	Coupar Angus Station	1.62
"	Okehampton, Oaklands	4.44	"	Blair Atholl	2.54
"	Harland Abbey	3.23	"	Montrose, Sunnyside Asylum	2.04
"	Lynmouth, Rock House	2.83	XVII.	Alford, Lynturk Manse	3.38
"	Probus, Lamellyn	4.39	"	Keith Station	1.85
"	Wellington, The Avenue	1.70	XVIII.	N. Uist, Lochmaddy	4.38
"	North Cadbury Rectory	1.96	"	Alvey Manse	2.65
VI.	Clifton, Pembroke Road	1.53	"	Loch Ness, Drumnadrochit	3.10
"	Moreton-in-Marsh, Longboro'	2.42	"	Glencarron Lodge	13.72
"	Rosa, The Graig	1.31	"	Fearn, Lower Pitkerrie	1.46
"	Shifnal, Hatton Grange	2.74	XIX.	Invershin	3.39
"	Cheadle, The Heath House	3.61	"	Altnaharra	5.88
"	Coventry, Kingswood	2.25	"	Bettyhill	3.72
VII.	Market Overton	2.74	"	Watten Station	2.81
"	Market Rasen	2.47	XX.	Dunmanway, The Rectory	3.19
"	Bawtry, Healey Hall	2.17	"	Cork	1.75
VIII.	Neston, Hinderton	3.01	"	Darrynane Abbey	5.02
"	Southport, Heaketh Park	3.03	"	Glenam [Clonmel]	3.12
"	Chatburn, Middlewood	...	"	Ballingarry, Gurteen	2.38
"	Cartmel, Flookburgh	4.70	"	Milton Malbay	4.88
IX.	Langsett Moor, Up. Midhope	3.88	XXI.	Gorey, Courtown House	2.33
"	Scarborough, Scalby	3.21	"	Moynalty, Westland	3.03
"	Ingleby Greenhow	2.90	"	Athlone, Twyford	2.63
"	Mickleton	2.88	"	Mullingar, Belvedere	2.92
X.	Bardon Mill, Beltingham	2.79	XXII.	Woodlawn	4.81
"	Ewesley, Fallowlees	1.63	"	Westport, Murriak Abbey	5.23
"	Iderton, Lilburn Cottage	2.04	"	Collooney, Markree Obay	5.25
"	Keswick, York Bank	4.08	XXIII.	Enniskillen, Portora	3.85
XI.	Llaufrechfa Grange	1.92	"	Warrenpoint, Summer Hill	1.32
"	Treherbert, Tyn-y-waun	5.09	"	Banbridge, Milltown	2.78
"	Carmarthen, The Friary	4.37	"	Belfast, Springfield	4.61
"	Castle Malgwyn [Llechryd]	4.10	"	Bushmills, Dundarave	4.95
"	Plylimon	12.85	"	Stewartstown, The Square	3.59
"	Tall-y-llyn	8.00	"	Killybegs	9.41
"	New Radnor, Ednol	3.54	"	Horn Head	5.11

METEOROLOGICAL NOTES ON DECEMBER, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Nearly normal temp. prevailed till the last ten days, when a period of severe frost brought the mean temp. down to $37^{\circ}\cdot 8$ or $1^{\circ}\cdot 4$ below the average. There were a number of brilliant days in the first half, but the latter part was cheerless and damp. Four and a half inches of S fell during the night of 25th, and the four following days were all more or less snowy. Duration of sunshine $37^{\circ}\cdot 2^{\circ}$,* and of R $51^{\circ}\cdot 6$, hours.

CROWBOROUGH.—Cold, with frequent squalls and much frost, especially in the last 12 days. Blizzard with 5 inches of S on Christmas night. R $\cdot 89$ in. below the average of 35 years. Mean temp. $35^{\circ}\cdot 7$.

TORQUAY.—Duration of sunshine $63^{\circ}\cdot 0^{\circ}$ hours, or 9·9 hours above the average; S 8 sunless days. Mean temp. $42^{\circ}\cdot 9$, or $0^{\circ}\cdot 7$ below the average.

CLIFTON.—The first and second weeks were showery, the third rainless, but damp and foggy, and the last frosty with S, although there was never more than an inch on the ground. R less than half the average.

ROSS.—Quite warm with much fine weather till 20th; the next three days cold, dry and "easterly," then about two and a half inches of S. The next four days were wintry but without much S; gentle thaw on 31st.

SOUTHPORT.—Extremely sunny yet exceptionally stormy. Duration of sunshine $46^{\circ}\cdot 6$ hours,* or $14^{\circ}\cdot 4$ above the average. Mean daily wind movement 50 miles above the average. R $\cdot 05$ in. above the average; duration $72^{\circ}\cdot 9$ hours. Mean temp. $38^{\circ}\cdot 7$, or $0^{\circ}\cdot 9$ below the average. The total depth of S was 9·3 in.

BOLTON.—A very wet month, with heavy S during the last week, when a fall of 8 inches on 25th, followed by lighter falls on 26th, 28th, 29th and 30th, produced a depth of 18 to 20 inches of undrifted S, the heaviest fall yet recorded for Bolton. Mean temp. $37^{\circ}\cdot 4$, or $1^{\circ}\cdot 5$ below the average. Duration of sunshine $24^{\circ}\cdot 5^{\circ}$ hours, or $11^{\circ}\cdot 2$ above the average.

HAVERFORDWEST.—Mild and stormy, with moderate R to 25th. S storm with gale on 26th, and S on 27th, 28th, and 29th; total depth 10 inches. In a severe gale on 5th a velocity of 82 miles per hour was recorded at Goodwick breakwater. Duration of sunshine $39^{\circ}\cdot 8^{\circ}$ hours.

DOUGLAS.—An excessively stormy month, mild from 16th to 21st, but otherwise generally cold, with bitter polar winds. Between one and two inches of S fell between 25th and 30th.

DUMFRIES.—Five inches of S on the night of 25th, followed by E. and N.E. gale, which caused drifts 8 to 10 feet deep, blocking roads, &c.

LYNTURK.—The feature of the month was the S storm from 26th to 28th. The drifting and blocking were unequalled since 1880.

DRUMADROCHIT.—R $1^{\circ}\cdot 32$ in. below, and rain days 1 above, the average of 20 years. The S storm which began on Christmas day was the most severe for many years.

WATTEN.—The first half was wet, with storms of wind and fine intervals, followed by a week of fine fresh and open weather. Great gales in the closing week, with heavy S and severe frost.

CORK.—R $2^{\circ}\cdot 70$ in. below the average, and mean temp. $3^{\circ}\cdot 2$ below the average.

MILTOWN MALBAY.—Bitterly cold and rainy, with little sunshine. The month ended in a furious blizzard, which lasted four days, accompanied by intense frost, gales and squalls.

DUBLIN.—The mean temp. was about the average, but varied from $46^{\circ}\cdot 9$ in the first week to $39^{\circ}\cdot 4$ in the second, $47^{\circ}\cdot 9$ in the third, and $34^{\circ}\cdot 7$ in the fourth. A period of S and frost set in on the morning of 26th, lasting till 30th.

OMAGH.—Till 19th the month was raw, damp and gloomy. Then a fine spell, followed again on 25th by heavy S and settled frost, which only disappeared with the advent of the New Year.

* Campbell-Stokes.

Climatological Table for the British Empire, July, 1906.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.	Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
	°		°		°		°	0-100.	°		inches		
London, Camden Square	83·7	18	45·2	1	76·0	54·6	57·9	75	129·2	40·5	·81	7	...
Malta.....	94·1	13	66·2	19	87·5	70·8	69·6	78	...	61·8	·00	0	1·2
Lagos.....	84·5	18	70·0	16	81·3	73·6	72·7	87	131·0	68·0	15·90	23	8·7
Cape Town	69·0	2	35·0	17	58·8	44·2	45·9	80	...	...	1·32	13	4·6
Durban, Natal	81·0	5	46·1	15	74·8	52·9	...	...	131·2	...	·28	6	2·0
Johannesburg	67·2	30	23·1	16	50·3	40·2	33·4	59	127·2	...	·00	0	0·9
Mauritius.....	76·8	15	55·1	28	74·4	62·5	60·1	77	136·9	47·7	5·53	26	6·8
Calcutta.....	93·1	13	74·5	2	89·7	79·5	78·2	85	159·0	73·1	12·69	17	8·3
Bombay.....	87·3	1	73·0	21	84·3	77·8	76·9	87	132·0	73·8	18·10	28	9·4
Madras.....	103·2	2	73·0	28	97·1	79·1	74·1	79	143·7	72·7	4·45	15	8·2
Kodaikanal	69·2	4	30·6	21	68·6	53·3	52·0	83	143·6	44·3	6·89	21	7·7
Colombo, Ceylon.....	89·2	21	74·4	19	85·8	77·6	73·9	81	149·0	73·0	4·42	14	7·3
Hongkong.....	91·2	21	75·9	23	87·7	79·5	76·2	80	143·7	...	6·95	17	7·3
Melbourne.....	64·9	12	33·0	26	56·4	44·2	41·4	75	118·2	27·3	1·34	10	6·7
Adelaide.....	74·0	11	39·3	24	60·0	46·2	45·3	77	120·8	34·1	2·87	18	6·4
Coolgardie	78·9	8	30·1	19	59·8	42·0	38·9	69	138·6	26·0	·88	10	5·0
Sydney.....	72·0	12	37·7	19	61·9	46·0	39·7	70	109·7	29·1	·20	12	2·9
Wellington.....	59·5	23	33·5	29	53·7	44·0	41·6	73	109·0	24·0	2·86	19	5·7
Auckland.....	63·0	19	41·0	28	56·9	46·5	45·5	79	115·0	37·0	6·80	26	7·0
Jamaica, Negril Point..	89·1	2, 15	69·1	25	87·2	73·2	73·9	70	...	...	4·83	15	...
Trinidad.....	95·0	27	60·0	sev.	86·3	71·1	73·8	84	162·0	67·0	11·42	16	...
Grenada.....	86·4	20	71·0	13	83·7	74·0	72·4	82	146·0	...	11·18	28	4·3
Toronto.....	92·1	22	50·8	6	79·9	60·3	61·1	75	112·0	43·0	3·41	9	4·9
Winnipeg.....	89·0	11	46·5	31	77·5	56·3	...	...	...	...	3·37	10	4·8
Victoria, B.C.	86·5	3	50·1	7	76·7	54·3	...	69	...	...	·16	1	2·6
Dawson.....	80·0	12	39·0	3	72·2	47·8	...	...	...	...	1·20	14	6·3
St. John's, N.B.	82·0	15	50·7	6	69·0	55·1	...	...	...	...	2·59	16	6·6

a and 31. b and 14, 24.

MALTA.—Mean temp. of air 77·4, or 0·4 below the average. Mean hourly velocity of wind 7·9 miles, or 0·5 above average. Mean temp. of sea 77·6.

MAURITIUS.—Mean temp. of air 0·3, dew point 0·7, relative humidity 1·2 per cent., and B 3·23 in. above, averages. Mean hourly velocity of wind 11·9 miles.

MADRAS.—TS on 4 days, distant T on 6 days, and L on 4 other days.

KODAIKANAL.—A cloudy and showery month. Bright sunshine 164 hours.

COLOMBO.—Mean temp. of air 81·3, or 0·6 above, of dew point 0·6 above, and B ·09 in. below, averages. Mean hourly velocity of wind 8·6 miles.

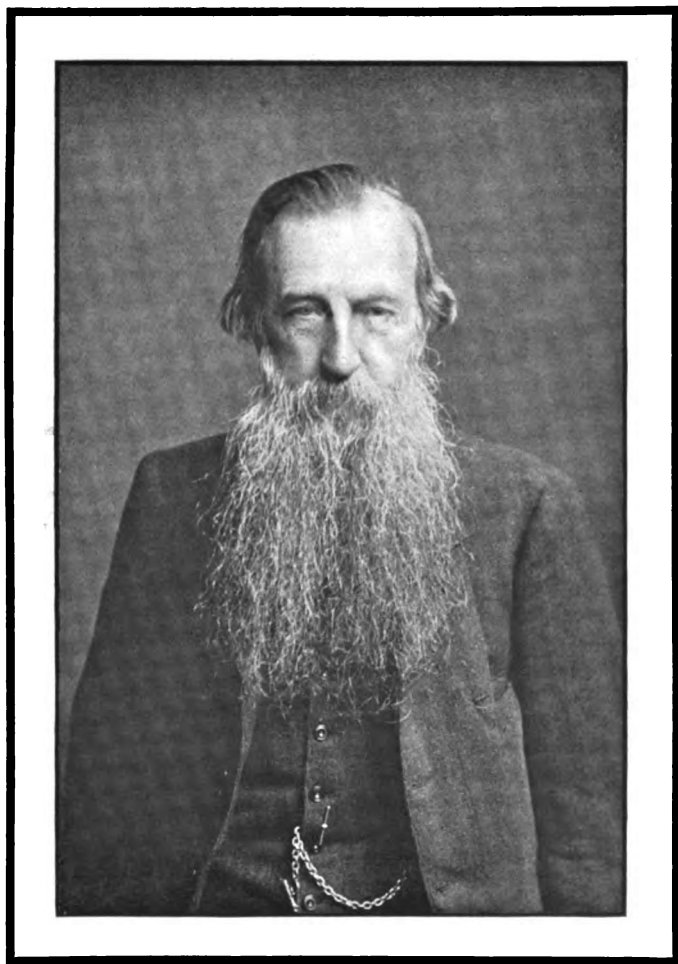
HONGKONG.—Mean temp. of air 82·9. Bright sunshine 215·2 hours. B 6·4 in. below, averages. Mean hourly velocity of wind 11·8 miles.

ADELAIDE.—Mean temp. of air 53·1, or 1·6 above, and B ·31 in. above average. The shade max., 74·0, on the 11th is the highest daily reading for July in 50 years.

SYDNEY.—Mean temp. of air 1·7 above, and B 4·36 in. below, averages.

WELLINGTON.—Mean temp. of air 1·3 above, and B 3·43 in. below, averages.

TRINIDAD.—B 2·38 in. above 43 years average.



ALEXANDER BUCHAN, M.A., LL.D., F.R.S.,

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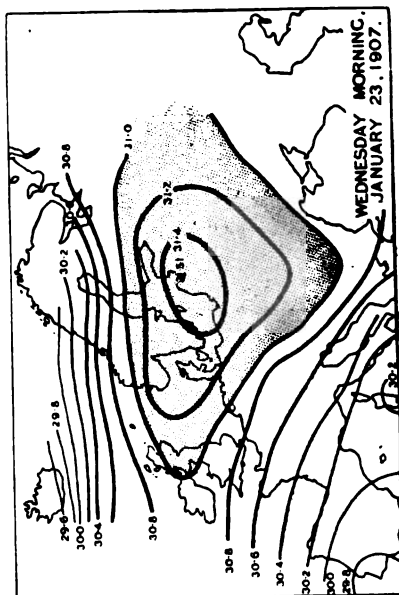
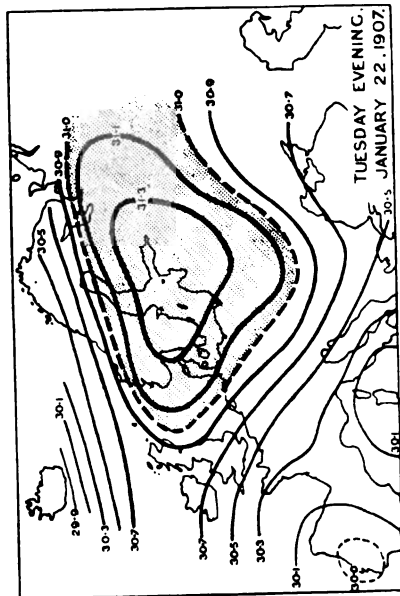
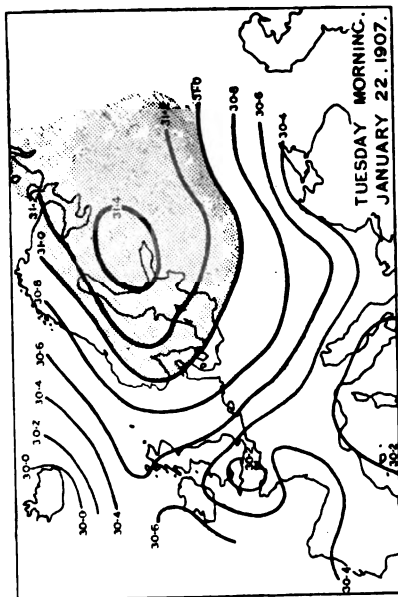
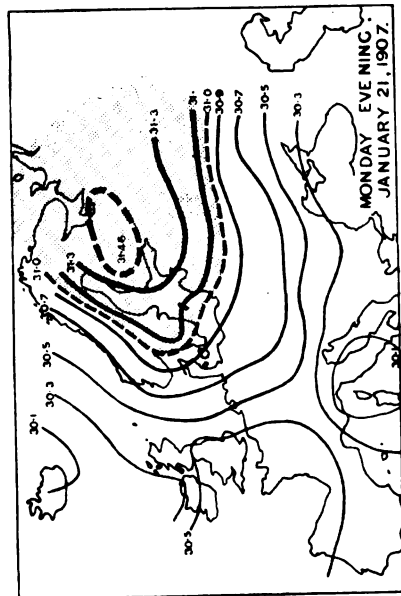
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THE HIGH BAROMETER OF JANUARY, 1907.



Symons's Meteorological Magazine.

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THE HIGH BAROMETER OF JANUARY, 1907.

By R. G. K. LEMPFT, M.A.

THE month of January, 1907, has established a record for high barometric readings which is probably, in its way, unprecedented in the annals of meteorology. The Daily Weather Report issued by the Russian Meteorological Office for Wednesday, January 23rd, records the reading 799·8 mm. at Pernau, on the Gulf of Riga, at the hour of evening observation on the previous day and a reading of like magnitude at Riga on the morning of the 23rd. 799·8 mm. is equivalent to 31·49 English inches, and if, as seems probable, the correction for reducing to latitude 45° has not been applied in the Russian Report, the finally corrected pressure value would be 31·51 in., the reading adopted in the report issued by the Bureau Central Météorologique of Paris.

The highest pressure, reduced to sea level, which has been observed on the face of the globe is, we believe, 31·72 in. recorded at Irkutsk in December, 1896. The present readings are thus less than the "record" by about 0·2 in. It should, however, be borne in mind that the Siberian station is several thousand feet above the level of the sea, so that the unreduced pressure value, as read off by the observer, was less than 31·7 in. by several inches. Both Pernau and Riga are on the shores of the Baltic, and the corrections for reduction to sea level are very small. We may therefore regard the readings quoted above as pressures actually experienced. From this point of view 31·51 in. probably establishes a new "record" in meteorological data.*

The distribution of pressure from the evening of January 21st to the morning of January 23rd is shown on the accompanying maps (see Plate facing p. 1). In each a large area is included within the space bounded by the isobar of 31·0 in. At 8 a.m. on the 23rd the pressure exceeded this limit over a large portion of Great Britain and a small district in the north-east of Ireland. The highest reading in the British Isles was reached at Aberdeen, at 10.15 a.m. on January 23rd. At this hour the Observatory barometer showed 30·957 in. at station level, which corresponds with 31·06 in. at mean

* See also this Magazine, Vol. 34 (1899), p. 81.

sea level. This falls short of Aberdeen's previous record, which happens also to be the record for the British Isles, by only .05 in.*

The history of the advance and development of the anticyclonic system shows some interesting features. Pressure had been over 31 in. over the north-west of Russia since the morning of the 20th, and during the following days it continued to increase steadily. On the evening of January 21st the highest reading was 31.46 in. in the centre of Finland, and the anticyclone had extended westward to the shores of the North Sea. Fresh or strong south-easterly winds were blowing on the Dutch, German and Danish coasts. The British Isles and the west of France were under the influence of an independent anticyclone, in which the highest readings were over the Bay of Biscay. The wind at the British stations was westerly or north-westerly. A trough of low pressure, extending in a south-east to north-west direction across the North Sea, separated the two opposing wind circulations. During the night the situation underwent a complete change. At 8 a.m. on January 22nd the oceanic anticyclone had receded beyond the west coast of Ireland, while the continental system had spread westward and set up easterly winds at all our east coast stations. A "depression," with a minimum reading of 30.24 in., covered the mouth of the English Channel.

The distribution of pressure on the evening of January 22nd and the morning of the 23rd, when the anticyclone attained its greatest intensity, may be seen in the accompanying maps. Steep gradients established themselves to the north and south of the region of highest pressure. A plentiful supply of warm air was accordingly carried from mid-Atlantic, past the north of Scotland, to the coast of Norway, while cold air, passing along the southern slope of the anticyclone, was brought from central to western and southern Europe. A most striking distribution of temperature resulted. At 8 a.m. on January 23rd the reading in the Färoe Islands was 46°, identical with that at Palermo. At Riga the thermometer stood at -22° F. and sharp frost prevailed over the greater part of southern Europe. At Rome the reading was 33°, or 6° lower than that at Bodoe, within the Arctic circle.

A south-westerly gale in the extreme north-west brought very warm air from southern latitudes to the neighbourhood of Iceland. The reading reported from Seydisfjord was as high as 59°, which is 1° higher than the simultaneous reading at the Azores, where the wind was northerly, and more than 10° higher than the readings on the coast of Algeria and Tunis. The possibility of telegraphic errors in the reports must be borne in mind, but equally high winter temperatures have been observed in Iceland under similar conditions in previous years. On the following day (January 24th) the wind veered to the north of west and the temperature fell rapidly to 29°.

* See also this Magazine, Vol. 37 (1902), pp. 5, 27.

Towards the end of the week the anticyclone moved slowly to the south-eastward and decreased in intensity. On the evening of Friday, January 25th, the region of highest pressure had been transferred to Asia Minor; the highest readings were still above 31 in.

WEATHER WHIMS.—I.

THE BUTTERFLY-HYGROSCOPE.

BY RICHARD INWARDS.

THIS philosophic toy is made from the seed of the Egyptian wild oat, see fig. 1. It will be observed that the seed is furnished with long awns, and that the thicker portion, or what may be termed the



FIG. 1.

thigh, is twisted, and is in all probability a modified leaf. But this part of the plant is highly hygroscopic and twists or untwists with the changes in the dampness of the air, so that it can be used to actuate the wings of the butterfly, see fig. 2, where the awn is seen fastened down by passing through the head of a small screw fitted with a shallow wing-nut in a recess cut in the wooden support. The left wing only is shown, and it is obvious that the awn which works the right wing must be placed in the opposite direction, or pointing towards the head.



The wings are of paper, painted in water colours, and the hinges, which must work

with very little friction, consist of holes through which pieces of fine wire pass freely—each wing must be a separate piece of paper. It is best to set the wings on a very damp day, when, after loosening the screws, the wings may be pressed together in a vertical position, and the screws lightly turned so as to hold them there. They will then open as soon as a drier state of the air sets in, and generally indicate by their position the moisture of the atmosphere. The butterfly should be hung on the wall in a passage, where there is no fire and where there is access to the open air. It is too fragile to work out of doors.

The hygroscopic property is doubtless a provision of nature to enable the seed to plant itself, for the action of the changes of

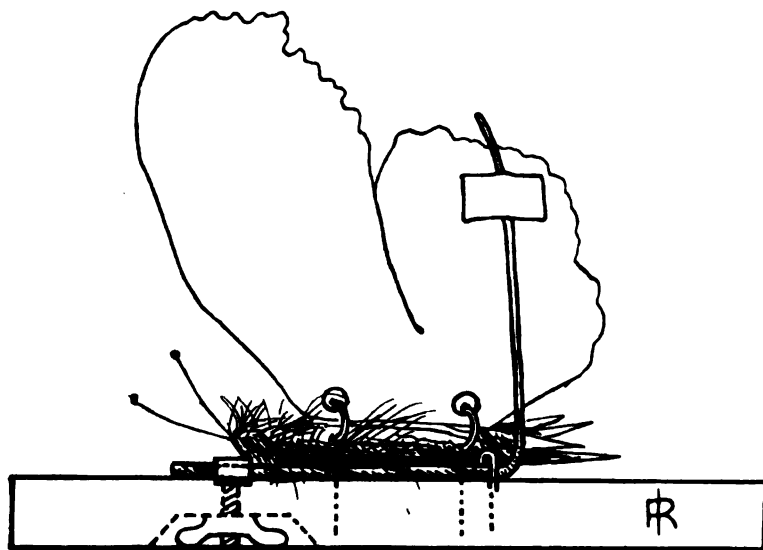


FIG. 2.

moisture being to twist and untwist the awn, and as the hairs and minute spines on the seed prevent it ever going backwards ; as soon as it gets its pointed end in any sort of moist hole or crevice, the turning about of the legs by pressing against any objects such as stones, or straws, or even against the ground itself, effectually plants the seed. If a number of the seeds are placed in a paper box with holes near the bottom it will not be long before half a dozen of the seeds are making attempts to get through the holes. It is diverting to see the behaviour of the seeds when the thighs are wetted. They twist slowly, and roll over and sometimes when the legs get entangled the seeds leap several times their own length, from the sudden releasing of the touching parts. The hygroscopic substance seems to be a grayish matter rolled up in the interior of the awn. Perhaps some chemist will tell us what it is.



THE LANDER RECORDING RAIN GAUGE.

A LANDER self-recording rain gauge has been tested at Camden Square during the greater part of the past year. The results have been compared with those of other automatic gauges of approved patterns and have generally been found to accord closely. There were few

opportunities of observing the gauge in conditions of real difficulty such as are presented in torrential rain of short duration and great amount. The one heavy rain was that of June 28th, 1906, but though 2.21 in. fell on that occasion it was spread over 8½ hours.

The instrument is of simple construction, having a funnel of the Snowdon pattern connected with a chamber containing a float which carries a recording pen moving upward between vertical guides. A continuous record is made upon a drum which may rotate daily or weekly. When an inch of rain has fallen the water reaches the bend of an open syphon, which starts without any mechanical device and empties the chamber in about 15 seconds. Although the objections to syphon action in recording gauges are numerous, we observed no instance of failure with the Lander gauge, though it must be stated that there was no opportunity of observing a discharge during torrential rain. A distinct advantage of this gauge is that it records the fall of a whole inch of rain before discharging and the liability to failure is thus greatly reduced, as rains of such an amount as to require more than one discharge are rare. There is an efficient heating arrangement for preventing damage in frost.

Our only real difficulty was with the clock, the time-keeping of which left something to desire, and the gearing was not altogether satisfactory. We should prefer to pay more for the instrument and have a clock of superior quality, for the condition of exposure to the variations of temperature and humidity is a very severe one. It is probably difficult to get a clock that can stand the test of a week's run in the open air without going seriously wrong, and for this reason we very strongly recommend the use of a drum which revolves in twenty-four hours instead of seven days. It is not necessary to change the paper daily, but the pen should be set to the correct time each morning. We can recommend the gauge when fitted with a daily drum to any observer who will not grudge a little care in setting and regulating the clock. The extremely moderate price brings this gauge within the reach of many to whom the cost of such gauges has hitherto been prohibitive.

It cannot, however, be too strongly pointed out that recording gauges of whatever pattern should never supersede the ordinary gauge for the measurement of amount, as however carefully attended to the liability to a failure of the mechanism always exists and the continuity of a record may be broken unless the observations are supplemented by those of an ordinary gauge.

A READERSHIP IN DYNAMICAL METEOROLOGY.

WE have much pleasure in giving publicity to the following important communication from the Meteorological Office :—

The Meteorological Committee are enabled by a private donation to appoint a Reader in Dynamical Meteorology, to hold office from October 1st, 1907, or such earlier date as may be arranged, under the following general conditions :—

1.—The Readership will be of the annual value of £350, and will be tenable for three years at any British University that may be approved for the purpose, and affords the required facilities.

2.—Candidates must produce evidence of being able to carry out original investigation of a mathematical character.

3.—The duty of the Reader will be primarily to promote the Science of Meteorology by mathematical investigation, and he will be expected to give annually a short course of about twelve lectures.

Further details may be obtained from the Director of the Meteorological Office, 63, Victoria Street, London, S.W.

Applications should be sent to the Director not later than 1st March, 1907, and should be accompanied by references, but no testimonials should be sent.

The further details referred to above are as follows :—

1.—The Readership is to be of the value of £350 per year, for three years, payable quarterly, and to be awarded by the Meteorological Committee. The appointment will date from the 1st October, 1907, or such earlier date as may be arranged by the Committee.

2.—The Readership is to be tenable at the University of Manchester, or such other University in the United Kingdom as may be approved by the Meteorological Committee, and may be willing to recognise the Reader as a Reader or Lecturer of the University.

3.—One term's residence during each academic year shall be required at the University concerned. The Reader will be expected to give one course of not more than twelve lectures, suitable for students of Physical Science, during each of the three years, provided that during the first year of his tenure he may be excused from the duty by the Meteorological Committee.

4.—The Reader is to devote the remainder of his time to study and research. He shall make himself acquainted with the work of the British Meteorological Office, and if possible with that of the meteorological establishments of one or more of the British colonies or dependencies, or of foreign countries. He may give at his option a course of post-graduate lectures on the subject of his research, provided that the total number of lectures given by him shall not exceed thirty in any one year. He may be called upon from time to time to furnish reports on the progress of his work.

5.—The readership is to be tenable simultaneously with any University or College Scholarship or Fellowship, provided that the duties attached to the emolument are not such as to interfere with the duties of the readership.

6.—The reader shall at the end of his term of office furnish a report to the Meteorological Office on the present methods of conducting and reducing meteorological observations.

7.—He shall also furnish during his tenure, or within a reasonable time

after the conclusion of his tenure, papers embodying the results of his researches. Such papers shall be submitted in the first instance to the Royal Society of London for publication.

8.—The following are suggested as subjects of investigation, but the Reader may submit any other subjects for approval of the Committee :—

The extension of Lord Rayleigh's investigation of the free vibration of the atmosphere (Scientific Papers, Vol. III., page 335) and its connection with the general theory of the diurnal variation of the barometer.

The dynamics of the motion of air represented by the trajectories of air in travelling storms. (See "Life History of Surface Air Currents," Meteorological Office Publication, No. 174).

The physical processes which may account for the sudden and almost discontinuous changes of pressure propagated with the velocities observed in the case of "line squalls."

Vortex motion in a uniformly rotating basin, treated with a view to possible application to the physics of the atmosphere.

9.—The Meteorological Committee reserve the right of making no appointment in default of suitable candidates.

10.—The Readership shall be vacated by (1) three months' notice by the holder of the office; (2) three months' notice by the Committee on the ground that the duties of the readership are not being duly performed; (3) by the acceptance of an appointment which in the opinion of the Committee interferes with the duties of the readership.

Adam F. W. Paulsen.

(1833–1907).

PROFESSOR A. F. W. PAULSEN, director of the Danish Meteorological Institute, died at Copenhagen on January 11th, at the age of 74. After winning a reputation as a physicist he devoted the latter part of his life to meteorology, in which sphere his talents were rendered the more useful by the wide area of ocean and polar sea embraced by the operations of the Danish Meteorological Institute. Among his important work in connection with the meteorology of the sub-polar regions may be mentioned his study of the aurora borealis. As recently as 1899 he took command of an expedition sent out by the Danish Government with the object of studying this interesting phenomenon, and an account of this was laid before the British Association at Southport in 1903.

A monument to the life-work of Professor Paulsen is the permanent telegraphic communication now established between Iceland and the mainland of Europe, by means of which vast service has been, and will doubtless yet be, rendered to meteorological knowledge. He also devoted much attention to the connection between the meteorological conditions of Greenland and those of Europe.

Professor Paulsen was a member of the International Meteorological Committee, and was frequently in attendance at international and other scientific gatherings. We owe a tribute also to his genial kindness in receiving foreign visitors at the Institute over which he presided in Copenhagen.

ROYAL METEOROLOGICAL SOCIETY.

THE annual general meeting of this Society was held on Wednesday evening, January 16th, at the Institution of Civil Engineers, Westminster, Mr. Richard Bentley, President, in the chair

The Council in their Report referred with satisfaction to the marked and increasing interest in Meteorology which has been apparent throughout the country. The scheme of lectures to local societies has proved successful, and there is reason to hope that it will lead to a substantial advance in the study of those scientific principles which it is the duty as well as the privilege of the Society to promote. The number of Fellows on the roll has been well maintained.

The Report having been adopted, the thanks of the Society were given to the Council and to the Auditors for their services, and also to the President and Council of the Institution of Civil Engineers for permitting the Society to hold its meetings at the Institution.

The President delivered an Address touching on the effects of "Weather in Warfare," in the course of which a large number of campaigns, sieges and battles were reviewed, and the influence of wind upon weapons and vessels in the early days of war dwelt upon. Many invasions in the days of small craft were frustrated by stormy weather from the time of Xerxes to those of the various Spanish Armadas sailing in succession to these shores; but now, with large vessels, good charts and instruments, storm warnings, and, above all, steam, this disability has passed away, and wind has ceased to be of as much importance as formerly, unless indeed hostile operations are transferred to the air itself. Restrictions of seasons were also illustrated in the attack on the Bocca Chica, on Buenos Ayres, in the siege of Louisberg, the terrible retreat from Russia, and in the operations on the Gold Coast. Fog has constantly been present during the operations of war, most frequently perhaps on land, though the sailors had their share at Barfleur, Cape St. Vincent, and before Tsushima. Indeed, on one memorable occasion, the *Centurion*, with Lord Anson on board, sailed through the French fleet undetected. Three great men lost their lives through fog, Sir Philip Sidney at Zutphen, Gustavus Adolphus, the Lion of the North, at Lützen, and the hard-fighting Scot, Marshal Keith, in the Seven Years' War. The result of the battle of Barnet was also due to fog, and Frederick the Great was misled by it at the battle of Lowositz. The part played by rain, too, is an important one in history, from the loss of Varus's legions in Westphalia down to the destruction of the Duke of Tarentum's army in Silesia. The siege of Vienna by Solyman failed through rain. Napoleon was defeated at Caldiero from the same cause, and General Lee's operations in 1863 during the American Civil War were hampered by it. Reference was also made to the passages of the Alps in snow from Hannibal's time to that of Napoleon, to the march of the Sikhs to relieve Chitral, and to

the snowstorms at the battles of Hohenlinden and Eylau, and during the French retreat from Russia. Ice appeared favourable to military operations, though it was employed for the defence of the Balkan passes, and in 1800 in the Tonale Pass on the Italian frontier the Austrians made use of it in cubes to build forts, which turned out to be impregnable. Charles the Tenth crossed from Sweden on the frozen Baltic to invade Denmark, and General Pichegru overran Holland in 1795 when its rivers and canals were frozen, and even captured the Batavian navy by sending his cavalry to sea—when their horses' feet were roughed—over the ice. Illustrations of campaigning under the difficulty of great heat were given from the time of the great Captain Gonsalvo de Cordova to Sir Charles Napier in Sind, and Lord Strathnairn in India, or to the recent battle of Yohereh in 1904. The destruction of Cambyses in a simoon and of the Emperor Julian in his Persian campaign were also alluded to. Two earthquakes during the last century occurred in sieges (at Patras, and at Jellalabad), and one happened during the battle of Trasimene. Several engagements took place in the height of gales, such as Admiral Hawke's victory at Quiberon and Admiral Rodney's off the Spanish coast. Towton, a snowstorm; Falkirk, rain; Culloden, wind; and Solferino, a whirlwind and thunderstorm, were further instances. Other interventions of the weather were noticed—the mirages which haunted the exhausted French troops in the desert, the lowering of the Baltic and of the Sea of Azof in special winds, which permitted the fortress of Stralsund and the celebrated lines of Perekop to be captured, and also the Isle of Ely in drought.

A hearty vote of thanks was given to Mr. Bentley for his services as President and also for his address.

The following were elected the Officers and Council for 1907 :—*President*, Dr. H. R. Mill; *Vice-Presidents*, Mr. R. Bentley, Capt. W. F. Caborne, C.B., Mr. E. Mawley, and Sir J. W. Moore, M.D.; *Treasurer*, Dr. C. T. Williams; *Secretaries*, Mr. F. C. Bayard and Mr. H. Mellish; *Foreign Secretary*, Dr. R. H. Scott, F.R.S.; *Council*, Col. J. E. Capper, C.B., Mr. J. E. Clark, Capt. M. H. Clarke, Mr. R. H. Curtis, Dr. H. N. Dickson, Mr. W. H. Dines, F.R.S., Mr. F. Druce, Mr. W. Ellis, F.R.S., Capt. M. W. C. Hepworth, C.B., Mr. R. Inwards, Mr. B. Latham and Dr. W. N. Shaw, F.R.S.

Mr. Bentley having vacated the chair, it was taken by Dr. H. R. Mill, the newly-elected President, who thanked the Fellows.

During the evening the following gentlemen were elected Fellows of the Society :—Col. A. Bibby, Mr. C. S. Bilham, Mr. B. L. Bradley, Col. H. Burton, Mr. K. Chowdry, Mr. E. G. Crocker, Capt. C. Etti, Mr. R. Falcon, Mr. W. C. George, Mr. H. T. Gibson, Mr. E. O. Gilbert, Mr. H. F. Kingdon, Gen. H. Le Cocq, Mr. J. W. Lovibond, Mr. C. W. Mallins, Mr. L. Miles, Lord Montagu of Beaulieu, Mr. M. Morgan, Mr. D. L. Richardson, Mr. E. S. A. Smith and Mr. M. W. Zambra.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

AUDIBLE METEORS.

THE observations of audible or detonating meteors present some difficulties, but these disappear when we consider the circumstances involved and put a fair and natural construction upon the facts.

Ordinary detonating fireballs are not very rare, and a good many instances have been recorded in scientific journals. The sound usually comes several minutes after the meteoric explosions (the time-intervals varying, of course, with the distance), the velocity being about 12 miles per minute.

The noise accompanying the actual descent of meteorites to the earth is different, for in many cases it precedes or accompanies the observed object when the latter falls near the spectator. We should expect this, because these celestial stones have a comparatively slow rate of speed. Descending vertically, or nearly so, and penetrating the soil to the extent of only 12 or 18 inches, it is certain the velocity cannot have exceeded that of terrestrial bodies, and it has been computed in several well-known instances that it amounted to only a few hundred feet per second. The planetary speed of these objects is effectually checked by atmospheric resistance, and they fall to the ground in nearly perpendicular directions, the Earth's attraction upon them having a great influence in the closing stages of their careers. In cases, therefore, of meteorites, the falls of which are actually witnessed, we naturally infer that the noise attending them will reach the observer's ear before the objects attract his eye, because sound travels faster than the bodies themselves.

But in regard to the hissing and similar noises often alleged to have been heard *simultaneously* with the passage of *ordinary* shooting stars and fireballs athwart the sky, these may be dismissed as imaginary. It is true that some of the observations appear to be of a remarkable and significant character. But when we reflect upon the mistakes often made by inexperienced persons in recording cosmical phenomena of unexpected and startling kind, it becomes easy to explain the anomalies presented. Some people have averred that on hearing a peculiar hissing sound, and looking up to ascertain the cause, they have seen a bright meteor rushing across the sky. In such cases the hissing must either have proceeded from a terrestrial source or have been a false sensation, the objects having been more than 100 miles distant from the observers according to reliable calculations subsequently made. Others have distinctly heard the residual particles of exploded meteors pattering on the trees close to them, while others again in various cases have detected a strong smell of sulphur instantly after meteoric disruptions, yet it has been proved by ample data that the spectators who received

such curious impressions were between 100 and 200 miles distant from the objects supposed to have caused them.

We have to allow a wide scope for observational illusions, not only in meteoric but in many branches of astronomy. And one of the most palpable of these illusions is the supposed hissing sometimes stated to accompany ordinary meteor-flights.

W. F. DENNING.

Bristol, Jan. 19, 1907.

MR. BROOK asks me (on page 231 of the January number) to explain how Mr. Huntley heard the sound before he saw the meteor. The answer is tolerably obvious if Mr. Huntley's language is attended to. He was not looking up until his attention was attracted by the sound. Then looking up he saw it still moving on. The sound had reached him from the nearest point in its path; but he did not see it until it had passed that point. The explanation suggested in the second paragraph of Mr. Brook's letter is inconsistent with the fact he recalls; for Mr. Huntley was startled, not by the sight of the phenomenon, but by the sound of it; and therefore could not have imagined the latter. The duration of the incandescence of the particles left by the meteor was sufficiently long to permit it to be looked for after the cause of the sound had passed away.

Mr. Brook, after admitting that meteors do emit sound, quotes Mr. Denning as if he had denied that they do. I do not so read the extracts; nor would I attribute such an opinion to him in the face of the conclusive evidence in the extracts I referred to in my last letter. Nor, apparently, has Mr. Brook seen Mr. Fordham's paper to which I referred as to the meteor of 1887, or he would have found that Hertford lay outside the area of shock as well as of sound, and 20 miles from the point of the explosion seen from there and heard near Brackley.

My own belief is that the sound of many more meteors would be noticed if observers would have the patience to wait at least two minutes before starting to discuss what they have seen.

JAMES G. WOOD.

January 22, 1907.

DIURNAL VARIATIONS OF PRESSURE.

IN the January number of your Magazine (Vol. 41, p. 233) you speak of "The regular diurnal variation in atmospheric pressure, in and near the Tropics." Is it *only* in and near the Tropics?

I remember in the long drought of 1887, we daily hoped for rain, from noticing a slight daily fall of the glass. It rose as regularly. I remarked on our disappointment to a sailor visiting us. He replied, "Oh, that is the tidal motion of the air; air has tides like water." I gathered that it was only in still weather we could observe

this slight movement, and that our latitudes have too stormy an atmosphere, in general, for the tidal movement to show.

On p. 227 of your Magazine it is said: "The oscillations (of the barometer) in high latitudes are much greater than those in the Tropics," where diurnal variation is observed.

I should like to know if air tides really exist. There seems no reason why the fluid air should not respond to the attraction of the sun and moon, as fluid water does, only air is more easily moved by local disturbances, which might obscure the daily rise and fall. Would there be two daily tides?

L. J. B. G.

18th Jan., 1907.

[The writer of the above letter is quite right in laying a questioning finger on the sentence quoted. Diurnal pressure changes may be detected in settled weather in any part of the world; but in the Tropics they form the most striking feature of the barometric curve except in the rarest cases. The constancy of the hours of the daily maximum and minimum point to the phenomenon in question being a result of thermal changes; were they due to gravitational causes the hour would change from day to day in accordance with the lunar phases, as hours of high and low water do. No doubt the differential attraction of the sun and moon raises tides in the air as in the ocean; but the amount of the tidal range in the atmosphere is so small and the incidental variations of pressure, due, *e.g.*, to the passing of clouds influencing temperature, are so great that the tidal effect is masked.—ED., *S.M.M.*]

HIGH BAROMETER—HALO.

ON January 23rd the reading of the barometer at 9 a.m. was 31.008 inches, and was probably a few thousandths higher between 10 a.m. and noon. This is the highest since 1878 except that of January 9th, 1896, and the sixth during the same period above 30.900. How is it that these extreme pressures have been so much more frequent in recent years?

On January 26th, from 2.40 p.m. for about 20 minutes, I saw a fine example of the circumzenithal halo; it extended for about one-sixth of the circumference of a circle of radius from 15° to 20° with the zenith as centre. The prismatic colours were fully developed, the red being nearest the sun. At the same time appeared a coloured parhelia, on the east side of the sun and about 22° distant, with a faint white tail directed from the sun for about 5° . There was no trace of any other halo, and clouds obscured the whole phenomenon at 3 p.m.

CHARLES L. BROOK.

Harewood Lodge, Meltham, Huddersfield, Jan. 31, 1907.

SUNSHINE RECORDER.

I HAVE read the letters *re* above on pages 168 and 188 of this Magazine in last year's volume.

I should attach special weight to Mr. Jordan's words as he is perhaps the pioneer of Photographic Sunshine Recorders, and speaks with undoubted authority. I have always understood that the primary objection to the Jordan Recorder has been the want of uniformity in the sensitiveness of the paper employed, and hence of the relative values of sunshine records taken at different periods. If this has been overcome it is a distinct step in advance.

Mr. Lander's statement that he has found a perfectly reliable paper, of uniform sensitiveness and of good keeping qualities, will be received with satisfaction by all who are interested in sunshine records; and it should lead to a fresh series of comparisons of records made with the Jordan, Lander, or other photographic instruments, and the Campbell-Stokes pattern. The results should go far to settle the question of the relative merits of the various instruments, and lead to general adoption of the instrument which appears to give the most accurate results.

I cannot, without confirmation, accept Mr. Lander's statement that a summer mid-day exposure of the chart in a Campbell-Stokes instrument for ten seconds will give a record of nearly ten minutes. On either side of the position of intensity one might find an elongated brown trace, but no one used to the Meteorological Office method of measurement would regard such as a measure of bright sunshine; allowance is always made in measuring the daily curves, whether of continuous, or intermittent sunshine, for lateral extension of trace.

Mr. Lander's reproduction of sun trace for April 27th is scarcely one that I should accept for the determination of the question. Unless it is a very poor reproduction it suggests an instrument out of focus. The lack of uniformity in the width of the trace and the blurring are such as I have not experienced with the Campbell-Stokes instrument, and would tend to an uncertainty in the time value of sunshine such as I should not expect to meet with.

From the experience of Mr. Jordan and Mr. Lander, together with that of gentlemen long used to the Campbell-Stokes instruments, one is led to hope that at no very distant date we may in the matter of sunshine measurement attain to *uniformity with accuracy*.

Falmouth Observatory, 12th February, 1907.

EDWD. KITTO.

SOLAR HALO ON JANUARY 4th.

A REMARKABLE halo was seen here during the afternoon of January 4th. I first noticed it at 2 p.m., when arcs of prismatic colour appeared on each side of the sun, the height of the sun above the horizon being then nearly equal to the distance of the arcs from the sun. These arcs gradually lengthened, the coloured portions remaining as they were, till about 3 p.m. there was a circle, complete

except close to the horizon, of white light, with a third patch of colour towards the zenith. The circle was barely visible after 3.30, but the patch of colour to the W. of the sun remained till close to sunset.

There was also a particularly brilliant and perfect lunar halo for several hours on the evening of December 29th.

H. A. BOYS, F.R.Met.Soc.

North Cadbury Rectory, Somerset, Jan. 5, 1907.

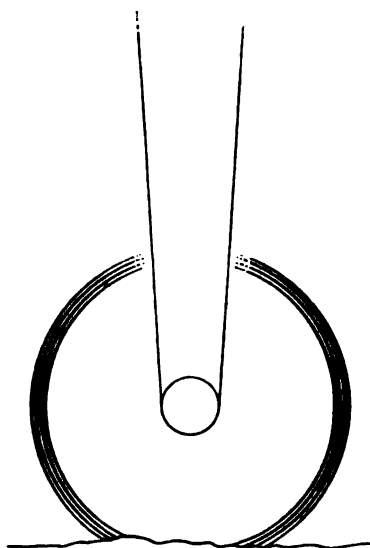
THIS afternoon I saw a very fine halo round the sun. I saw it first at 1.30 p.m. and off and on until 3.30, when it was very distinct, but disappeared about 3.45, when the clouds hid the sun. It was coloured like a rainbow, the colours being much more distinct at the highest point and at the extreme right and left; I could not see the lowest point.

When the lowest point was about on the horizon the highest would be nearly halfway to the zenith. There was no appearance of false suns in the halo, the points I have spoken of being merely brighter in colour than the rest of the halo.

I spend a good part of my time out of doors, and I notice most things that are to be seen, but I have only once before seen a solar halo, about seven or eight years ago, in the winter and late in the afternoon.

T. LAMBERT HALL.

Dilwyn, January 4th, 1907.



Solar Halo January 4th 1907,

Heathfield, Purlieu, Southampton, January 4th, 1907.

THERE was a magnificent halo round the sun here to-day. I noticed it first at 2.30 p.m. At that hour the circle seemed about 33° from the sun's disc, and was red on the inner side, light yellow in the middle, and violet-blue on the outside. What struck me most was a very light, I might almost say white, streak from the sun's disc upwards, quite hiding the ring, apparently 3 or 4 degrees. This remained until about 3.45 p.m., when the bright streak died out and left the circle above the horizon complete. At 4 p.m. all had disappeared. It was bright sunshine all day. Wind S.W., light. Thermometer at 9 a.m. showed a minimum of 30° and a maximum of 43° .

JESSE REEVES.

METEOROLOGICAL NEWS AND NOTES.

DR. W. N. SHAW, Director of the Meteorological Office, has been appointed Reader in Meteorology in the University of London.

SIR CHARLES TODD, for fifty years the head of the Meteorological Service of South Australia, has retired, still well and hearty, at the age of eighty, and has been succeeded, we understand, by Mr. R. F. Griffith, who has long taken a leading part in the meteorological work at Adelaide Observatory.

AN OCEANOGRAPHICAL LABORATORY, under the direction of Mr. W. S. Bruce, was opened on January 16th in Edinburgh by the Prince of Monaco. The laboratory is united with a museum of polar and marine natural history, and will be occupied in the first instance, we understand, in preparing the results of the Antarctic expedition in the *Scotia* for publication.

THE IMPERIAL-ROYAL GEOGRAPHICAL SOCIETY OF VIENNA celebrated the fiftieth anniversary of its foundation on December 4th in a special meeting presided over by H.I.H. the Archduke Rainer, at which the Honorary Membership of the Society was conferred on representatives of various departments of Geography, amongst whom the following have been associated mainly with meteorological or oceanographical work: Prof. F. A. Forel of Geneva, Prof. G. Hellmann of Berlin, Dr. H. R. Mill of London, Sir John Murray of Edinburgh and Dr. A. Voiehoff of St. Petersburg.

MR. WILLIAM MARRIOTT was presented at the Annual General Meeting of the Royal Meteorological Society with an illuminated Address in recognition of his services as Lecturer for the Society. The Address, which was signed by the individual members of the Council of the Society, ran as follows:—

“The first course of lectures and exhibitions given on behalf of the Royal Meteorological Society having proved so popular as to lead to a further continuance, the Council of the Society avail themselves of the opportunity of placing on record their appreciation of the able manner in which MR. WILLIAM MARRIOTT performed the duties of Lecturer and Demonstrator, which contributed greatly to the success of the scheme. The Council desire at the same time to acknowledge the zeal and interest Mr. Marriott has shown at all times in the affairs of the Society, his many valuable contributions to the Journal and to the other publications of the Society during so many years, and also the courteous manner with which he has placed his knowledge and long experience at the service of observers in all parts of the country.”

“THERMOMETER READINGS BELOW ZERO have been the order of the day and night,” observed a local paper of the winter of 1906–7, while a meteorological observer in the same town writes to us:—“How little frost we have had this winter; it must be almost a record for the absence of severe cold.” It is a relief to find by reading farther that the journalist treated “32° F.” and “zero” as synonyms, and an apparent example of appalling mendacity is reduced to an instinctive feeling of the appropriateness of the point of departure of the thermometer scales not used in England.

TEMPERATURE FOR JANUARY, 1907.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				No. of Night- ator below 32°	
					Max.		Min.		Shade.	Grass.
					°	Date.	°	Date.		
Camden Square.....	London.....	51 32	0 8	111	51.4	1	22.1	24	11	20
Tenterden.....	Kent.....	51 4	0 41	190	50.0	1, 17	16.5	24	11	21
West Dean.....	Hampshire.....	51 3	1 38	137	50.0	1	19.0	24	15	21
Hartley Wintney.....	.....	51 18	0 53	222	52.0	12†	20.0	18, 27	17	21
Hitchin.....	Hertfordshire.....	51 57	0 17	238	50.0	1	20.0	25	15	...
Winslow (Addington).....	Buckinghamsh.	51 58	0 53	309	51.0	13	17.0	25	17	23
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	0 40	226	50.5	15	20.0	24‡	14	...
Brundall.....	Norfolk.....	52 37	* 1 26	66	48.8	12	14.8	27	14	16
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	50.2	1	16.0	25	10	15
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	52.1	1	24.7	25	5	9
Polapit Tamar [Launceston].....	.....	50 40	4 22	315	51.8	1	22.0	24	6	14
Bath.....	Somerset.....	51 23	2 21	67	52.8	1	20.1	25	12	...
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	48.0	1, 8	21.0	24, 25	15	...
Church Stretton (Woolstaaton).....	Shropshire.....	52 35	2 48	800	49.0	1	7.0	25	31	...
Bromsgrove (Stoke Reformatory).....	Worcestershire.....	52 19	2 4	225	51.0	12	10.0	24	22	...
Boston.....	Lincolnshire.....	52 58	0 1	25	48.0	12	15.0	25	16	...
Worksop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	51.5	12	14.7	25	17	29
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	51.0	12	13.0	24	16	...
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	49.7	1	17.0	25	9	18
Wetherby (Ribston Hall).....	Yorkshire, W.R.	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage.....	.....	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park).....	E.R.	53 45	0 20	6	50.0	12	19.0	25	15	29
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	49.6	12	19.4	24	11	...
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street).....	Pembroke.....	51 48	4 58	95	51.6	7	14.7	25	5	8
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	49.0	1	11.0	23, 24	...	...
Llandudno.....	Caernarvon.....	53 20	3 50	72	53.0	2, 12	20.0	25	5	...
Cargen [Dumfries].....	Kirkcudbright.....	55 2	3 37	80	51.0	12	22.0	24§	11	...
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	48.0	12	17.0	30	17	26
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	50.1	5	20.7	24	11	15
Colmonell (Clachanton).....	Ayr.....	55 8	4 54	140	...	...	...	...	...	...
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	48.0	5, 7, 12	18.0	24	11	19
Tighnabruaich.....	Argyll.....	55 55	5 14	50	44.0	7, 17	20.0	23, 31	15	16
Mull (Quinish).....	.....	56 36	6 13	35	47.0	7, 14, 28	...	...	...	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	53.4	12	21.3	1	14	...
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford).....	.....	57 8	2 7	120	52.0	15	20.0	25§	24	...
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	53.0	8	22.5	26	14	...
Castletown.....	Caithness.....	58 35	3 23	100	51.0	16	23.0	25, 26	18	19
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	56.0	6	17.5	24	...	...
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	54.0	12, 28	19.0	25	8	...
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	52.0	1	22.0	23	14	...
Carlow (Brown's Hill).....	Carlow.....	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	53.5	28	27.5	25	4	16
Ballinasloe.....	Galway.....	53 20	8 15	160	...	...	...	...	...	...
Clifden (Kylemore House).....	.....	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...	...
Seaforde.....	Down.....	54 19	5 50	180	50.0	5	24.0	22	12	16
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	51.0	5	20.0	23	1	14

† and 13, 14.

‡ and 25, 26.

§ and 26, 31

RAINFALL FOR JANUARY, 1907.

RAINFALL OF MONTH.						RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
Aver. 70-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.	No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.		
in.	in.	in.	in.	in. Date.		in.	in.	in.	in.	in.	
1'89	'91	— '98	48	'46 1	8	...	...	...	...	25'16	Camden Square
2'36	1'00	—1'36	42	'48 1	10	...	...	...	...	28'36	Tenterden
2'68	'85	—1'83	32	'56 1	9	...	...	...	...	29'93	West Dean
2'39	'66	—1'73	28	'31 1	8	...	...	...	...	27'10	Hartley Wintney
1'81	'97	— '84	54	'42 1	11	...	...	...	...	24'66	Hitchin
2'05	'96	—1'09	47	'54 1	8	...	...	...	...	26'75	Addington
1'70	1'29	— '41	76	'38 1	11	...	...	...	...	25'39	Westley
1'67	1'72	+ '05	103	'36 26	17	...	...	...	...	25'40	Brundall
3'90	2'17	—1'73	56	'77 1	16	...	...	...	...	39'00	Winterbourne Stpltn
3'19	1'73	—1'46	54	'76 1	13	...	...	...	...	35'00	Torquay
3'87	2'73	—1'14	71	'72 2	19	...	...	...	...	38'85	Polapit Tamar
2'52	1'23	—1'29	49	'47 1	12	...	...	...	...	30'75	Bath
2'46	1'30	—1'16	53	'58 1	11	...	...	...	...	29'85	Stroud
2'81	1'76	—1'05	63	'50 2	12	...	...	...	...	33'04	Woolstaston
1'91	'83	—1'08	43	'23 2	10	...	...	...	...	24'50	Bromsgrove
1'59	'78	— '81	49	'25 1	5	...	...	...	...	23'30	Boston
1'74	'75	— '99	43	'19 1	8	...	...	...	...	24'70	Hodsock Priory
1'95	1'15	— '80	59	'37 2	12	...	...	...	...	26'18	Derby
3'38	2'30	—1'08	68	'49 1	20	...	...	...	...	42'43	Bolton
1'89	1'30	— '59	69	'60 28	7	...	...	...	...	26'96	Ribston Hall
6'33	3'46	—2'87	55	'96 28	14	...	...	...	...	60'96	Arncliffe Vic.
1'80	1'01	— '79	56	'31 30	12	...	...	...	...	27'02	Hull
1'96	'48	—1'48	24	'15 1	11	...	...	...	...	27'99	Newcastle
14'71	6'01	—8'70	41	1'00 28	20	...	...	...	...	132'68	Seathwaite
3'85	2'79	—1'06	72	'88 1	19	...	...	...	...	42'81	Cardiff
5'13	2'28	—2'85	44	'60 1	20	...	...	...	...	47'88	Haverfordwest
3'87	3'34	— '53	86	'64 2	19	...	...	...	...	45'41	Gogerddan
2'57	1'42	—1'15	55	'36 1	15	...	...	...	...	30'98	Llandudno
2'54	2'02	—2'52	44	'49 29	9	...	...	...	...	43'43	Cargen
2'60	1'04	—1'56	40	'48 1	12	...	...	...	...	33'04	Riddell House
...	'84	...	...	'29 28	10	...	...	...	...	...	Edinburgh
4'52	2'50	—2'02	55	...	...	...	...	...	...	44'85	Colmonell
3'25	1'86	—1'39	57	'40 27	17	...	...	...	...	35'80	Glasgow
5'86	4'10	—1'76	70	'52 27	18	...	...	...	...	57'90	Tighnabruaich
5'85	4'59	—1'26	78	'58 4	26	...	...	...	...	57'53	Quinish
2'10	'95	—1'15	45	'45 1	12	...	...	...	...	28'95	Dundee
2'91	1'61	—1'30	55	...	...	...	...	...	...	36'07	Braemar
2'32	1'89	— '43	81	'51 1	17	...	...	...	...	33'01	Aberdeen
2'14	1'70	— '44	79	'27 28	18	...	...	...	...	29'37	Cawdor
6'63	6'36	— '27	96	1'20 28	12	...	...	...	...	56'00	Invergarry
8'75	9'48	+ '73	108	1'10 26	28	...	...	...	...	86'50	Bendamp
2'62	4'12	+1'50	157	1'06 2	17	...	...	...	...	31'60	Dunrobin Castle
...	3'89	...	...	'65 1	24	...	...	...	...	...	Castletown
6'57	2'38	—4'19	36	'63 1	15	...	...	...	...	58'11	Killarney
4'06	'79	—3'27	19	'19 1	17	...	...	...	...	39'30	Waterford
2'98	1'44	—1'54	48	'38 1	20	...	...	...	...	33'47	Hurdlestown
3'15	...	...	...	...	...	...	...	...	...	34'44	Carlow
2'16	'43	—1'73	20	'19 1	9	...	...	...	...	27'75	Dublin
3'49	...	...	...	...	...	...	...	...	...	37'04	Ballinasloe
7'86	3'83	—4'03	49	'60 3	19	...	...	...	...	80'23	Kylemore House
5'00	3'30	—1'70	66	'64 1	23	...	...	...	...	50'50	Ennisceoe
3'63	1'39	—2'24	38	'55 1	12	...	...	...	...	38'61	Seaforde
3'56	3'47	— '09	97	'72 1	20	...	...	...	...	41'20	Londonderry
3'34	2'25	—1'09	67	'40 1	20	...	...	...	...	37'85	Omagh

SUPPLEMENTARY RAINFALL, JANUARY, 1907.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	1.02	XI.	Rhayader, Tyrmynydd	...
"	Ramsgate, West Cliff Villas	.87	"	Lake Vyrnwy	3.47
"	Hailsham	1.09	"	Llangyhanfal, Plas Draw	1.21
"	Crowborough, Uckfield Lodge	1.58	"	Criccieth, Talarvor	2.40
"	Osborne, Newbarn Cottage	.85	"	Llanberis, Pen-y-pass	7.20
"	Emsworth, Redlands	.92	"	Lligwy	1.61
"	Alton, Ashdell	1.27	"	Douglas, Woodville	1.79
"	Newbury, Welford Park	.71	XII.	Stoneykirk, Ardwell House	1.96
III.	Harrow Weald, Hill House	1.00	"	Dalry, The Old Garroch	4.41
"	Oxford, Magdalen College	.54	"	Langholm, Grove Road	2.46
"	Bloxham Grove	.85	"	Moniaive, Maxwellton House	2.26
"	Pitaford, Sedgebrook	1.04	XIII.	N. Esk Reservoir [Penicuik]	2.45
"	Huntingdon, Brampton	1.03	XIV.	Maybole, Knockdon Farm	1.95
"	Wisbech, Bank House	1.09	XV.	Campbeltown, Witchburn	2.55
IV.	Southend Water Works	1.15	"	Inveraray, Newtown	6.65
"	Colchester, Lexden	.87	"	Ballachulish House	7.52
"	Newport, The Vicarage	.97	"	Islay, Eallabus	3.62
"	Rendlesham	1.13	XVI.	Dollar Academy	2.76
"	Swaffham	1.10	"	Loch Leven Sluice	2.44
"	Blakeney	...	"	Balquhider, Stronvar	4.09
V.	Bishops Cannings	1.04	"	Perth, Pitcullen House	1.19
"	Ashburton, Druid House	2.16	"	Coupar Angus Station	1.16
"	Okehampton, Oaklands	2.69	"	Blair Atholl	2.46
"	Hartland Abbey	1.84	"	Montrose, Sunnyside Asylum	1.09
"	Lynmouth, Rock House	2.40	XVII.	Alford, Lynturk Manse	1.50
"	Probus, Lamellyn	1.78	"	Keith Station	2.05
"	Wellington, The Avenue	1.36	XVIII.	N. Uist, Lochmaddy	4.12
"	North Cadbury Rectory	.83	"	Alvey Manse	2.65
VI.	Clifton, Pembroke Road	2.11	"	Loch Ness, Drumnadrochit	2.40
"	Ross, The Graig	2.18	"	Glencarron Lodge	13.11
"	Shifnal, Hatton Grange	1.43	"	Fearn, Lower Pitkerrie	1.64
"	Cheadle, The Heath House	1.14	XIX.	Invershin	4.22
"	Blockley, Upton Wold	1.35	"	Altnaharra	5.25
"	Coventry, Kingswood	1.04	"	Bettyhill	3.72
VII.	Market Overton	.87	"	Watten Station	2.83
"	Market Rasen	1.11	XX.	Dunmanway, The Rectory	2.70
"	Bawtry, Hesley Hall	.61	"	Cork	1.07
VIII.	Neston, Hinderton Lodge	.92	"	Darrynane Abbey	2.92
"	Southport, Esketh Park	1.28	"	Glenam [Clonmel]	.88
"	Chatburn, Middlewood	2.35	"	Ballingarry, Gurtene	1.38
"	Cartmel, Flookburgh	2.41	"	Milton Malbay	2.25
IX.	Langsett Moor, Up. Midhope	2.25	XXI.	Gorey, Courtown House	.42
"	Scarborough, Scalby	1.55	"	Moynalty, Westland	1.39
"	Ingleby Greenhow	.82	"	Athlone, Twyford	1.59
"	Mickleton	1.62	"	Mullingar, Belvedere	1.07
X.	Bardon Mill, Beltingham	.83	XXII.	Woodlawn	2.45
"	Ewesley, Fallowles	1.09	"	Westport, Murriak Abbey	1.94
"	Ilderton, Lilburn Cottage	.79	"	Collooney, Markree Obay	3.07
"	Keawick, York Bank	2.28	XXIII.	Enniskillen, Portora	2.08
XI.	Llanfrecfa Grange	2.97	"	Warrenpoint, Summer Hill	...
"	Treherbert, Tyn-y-waun	5.22	"	Banbridge, Milltown	1.03
"	Carmarthen, The Friary	2.76	"	Belfast, Springfield	2.54
"	Castle Malgwyn [Llechryd]	2.34	"	Bushmills, Dundarave	2.97
"	Plynlimon	8.05	"	Stewartstown, The Square	1.90
"	Tall-y-llyn	2.00	"	Killybegs	5.76
"	New Radnor, Ednol	2.47	"	Horn Head	2.83

METEOROLOGICAL NOTES ON JANUARY, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—After a wet day on 1st, followed by a westerly gale on 2nd, the first half of the month proved mild and very dry but rather dull. Frost set in on 18th, and from 22nd to the end it was cold with little R and bitter winds at times. Mean temp. $38^{\circ}8$, or $0^{\circ}7$ above the average. Duration of sunshine $40\cdot1^*$ hours and of R $18\cdot1$ hours.

CROWBOROUGH.—The first 17 days were mild and entirely free from frost, but from 18th wintry weather set in with continuous frost. Min. temp. in screen $16^{\circ}4$, on 24th. R $1\cdot70$ in. below the average of 35 years.

HARTLEY WINTNEY.—The driest January since 1892. The first fortnight was warm and spring-like with several sunny days, the latter more wintry with slight S, frost and keen N. and N.E. winds and cloudy days. Ozone occurred on every day, with a mean of 4·3.

TORQUAY.—Duration of sunshine $85\cdot4^*$ hours, or $21\cdot5$ above the average. Mean temp. $42^{\circ}6$, or $0^{\circ}1$ above the average.

NORTH CADBURY.—The driest January in 11 years and the coolest since 1897. The first two-thirds of the month were mild, but the last ten days cold, especially 23rd and 24th, which were both colder than any other day in 11 years.

SOUTHPORT.—Dry and exceptionally sunny. Very mild generally until 17th, but afterwards more wintry. Mean temp. $39^{\circ}4$, or $0^{\circ}4$ above the average. R $1\cdot42$ in. below the average. Duration of sunshine $53\cdot7^*$ hours, or $10\cdot3$ hours above the average. Duration of R $26\cdot9$ hours.

BOLTON.—The first part was comparatively mild, but on 23rd the temp. fell 9° and the weather was afterwards severe. The 25th was the coldest day since 1894. Duration of sunshine $25\cdot0^*$ hours, or $3\cdot5$ hours above the average.

HAVERFORDWEST.—Cold at times and very changeable. Hard frost from 22nd to 25th. Duration of sunshine $73\cdot6^*$ hours.

DOUGLAS.—The month opened with cold R and strong W. gales, and H on 4th, followed by a mild fortnight with many sunny days. Real winter set in on 20th with hard frost to the end. On 23rd the bar. reached $30\cdot98$ in.

COUPAR ANGUS.—Mean temp. $1^{\circ}0$ below and R about 50 per cent. below the average. A noteworthy feature of the month was the high pressure and great range and fluctuation of the bar.

BLAIR ATHOLL.—Seasonable till 5th, then remarkably mild till 17th, after which frost was continuous to the end, with S during the last week.

DRUMNADECHIT.—R $1\cdot44$, and rain days 3, below the average of 21 years. Gale on 28th accompanied by distant T.

CASTLETOWN.—The first part was rather wet and on the whole mild. From 15th to 23rd was remarkably fine and dry; on 23rd the bar. reached $31\cdot15$ in. On 28th there was a heavy westerly gale with S storm and the bar. fell to $28\cdot87$ in. soon rising again. The last few days were stormy, with S and H.

DUNMANWAY.—On the whole cold and dry, especially from 21st to 30th, with skating on 25th and 26th; this occurs only about once in five years here.

CORK.—R $3\cdot13$ in. below, or only about one-fourth of, the average. Mean temp. $2^{\circ}1$ below the average.

CLONMEL.—The driest January recorded since 1865.

MILTOWN MALBAY.—The first week was cold, blustry and "dropping", then to 21st mild, after which sharp frost intervened for three or four days. Stormy weather with squalls, H, S and R from 29th.

DUBLIN.—Remarkable for the high mean bar., $30\cdot303$ in., the scanty R falling only during 20 hours, the warm anticyclonic winds from 5th to 18th, and the biting easterly anticyclonic winds from 19th to 25th. The mean temp. was $42^{\circ}7$, or $1^{\circ}1$ above the average.

OMAGH.—The temp. of the month was above the average, but the R below. The month varied little from the normal in other respects.

* Campbell-Stokes.

Climatological Table for the British Empire, August, 1906.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.		Cloud.
	Temp.	Date.	Temp.	Date.										
	°		°		°	°	°	0-100	°	°	inches			
London, Camden Square	93·2	31	45·7	29	77·1	55·3	56·3	74	130·5	42·4	·87	8	...	
Malta.....	28·0	6	67·3	25	88·3	72·6	68·3	69	...	62·4	1·76	3	0·7	
Lagos.....	85·0	5a	71·0	18	82·6	73·8	71·7	80	137·0	68·0	1·68	13	7·9	
Cape Town ..	76·0	3	33·1	8	59·8	44·3	44·4	74	...	...	2·86	14	5·5	
Durban, Natal	95·9	14	47·0	3, 4	75·6	54·1	...	...	138·4	...	·27	5	3·0	
Johannesburg	78·0	24	27·0	2	64·2	40·8	33·6	59	138·0	23·2	·00	0	0·4	
Mauritius.....	77·4	14	51·6	15	74·9	61·0	58·9	74	139·7	43·9	1·84	17	5·7	
Calcutta.....	91·7	31	75·9	15	88·4	78·7	77·7	85	157·0	74·5	8·14	18	8·2	
Bombay.....	87·8	16	75·4	20	84·6	77·9	76·0	85	131·7	71·0	20·91	25	8·4	
Madras.....	97·9	30a	73·5	20	92·0	77·3	75·2	80	144·3	72·7	4·45	12	5·2	
Kodaikanal	67·1	16	50·3	14	62·5	52·5	53·8	89	140·4	42·5	12·44	27	7·9	
Colombo, Ceylon.....	37·2	30	71·6	15	85·2	77·2	74·0	83	149·2	70·2	5·86	14	7·2	
Hongkong.....	93·7	28	74·6	30	88·8	79·1	75·8	79	143·9	...	3·97	10	5·3	
Melbourne.....	67·6	9	31·1	30	57·0	43·0	42·8	78	122·4	24·8	1·73	13	7·5	
Adelaide.....	67·0	23	36·1	28	60·2	45·8	45·0	76	124·5	32·1	3·97	16	7·0	
Coolgardie	70·6	21	36·4	1, 25	59·5	43·7	40·0	71	139·0	30·1	3·27	8	5·6	
Sydney.....	73·0	25	40·7	28	61·5	47·7	43·8	75	104·1	31·8	5·64	18	5·0	
Wellington	65·5	20	33·5	3, 8	53·8	43·2	42·0	76	115·0	23·0	2·80	10	5·0	
Auckland.....	62·0	30	38·0	8	56·9	47·3	44·6	76	120·0	33·0	1·76	11	5·6	
Jamaica, Negril Point..	91·0	20	66·1	18	87·3	72·7	73·0	77	...	...	4·87	11	...	
Trinidad.....	90·0	13a	69·0	sev.	86·1	70·9	74·2	86	166·0	67·0	8·55	24	...	
Grenada.....	88·4	29	70·2	6, 7	84·6	74·3	72·4	80	145·0	...	11·87	25	4·1	
Toronto.....	89·0	5	52·0	29	81·1	62·6	62·3	75	113·5	45·4	1·83	11	4·5	
Fredericton	92·8	17	31·8	31	77·1	53·1	...	...	...	...	1·33	6	4·5	
St. John's, N.B.	81·6	7	50·5	25	70·7	56·1	...	...	...	...	1·29	12	5·0	
Victoria, B.C.	80·5	26	45·4	16	72·9	51·7	...	74	...	...	·53	4	2·6	
Dawson.....	78·0	4	30·0	23	67·9	40·2	...	...	...	...	1·46	11	5·8	

a and 6, 31. b and 31. c and 14.

MALTA.—Mean temp. of air 79°·3, or 1°·2 above the average. Mean hourly velocity of wind 8·5 miles, or 1·2 above average. Mean temp. of sea 79°·8.

MAURITIUS.—Mean temp. of air 0°·4, dew point 0°·5, and R 40 in. below, averages. Mean hourly velocity of wind 9·9 miles, or 2·4 below average.

KODAIKANAL.—Abnormally wet and cloudy month. Bright sunshine 90 hours.

COLOMBO.—Mean temp. of air 80°·8 (average), of dew point 0°·8 above, and R 2·21 in. above, averages. Mean hourly velocity of wind 8·5 miles.

HONGKONG.—Mean temp. of air 83°·2. Bright sunshine 231·2 hours, or 85·2 hours above average. R 10·25 in. below average. Mean hourly velocity of wind 6·7 miles.

ADELAIDE.—Mean temp. of air 53°·0, or 0°·8 below, and R 1·63 in. above, averages. Most cloudy August on record. Sunshine 41 hours less than average.

SYDNEY.—Mean temp. of air 0°·2 below, and R 2·42 in. above, averages.

WELLINGTON.—Mean temp. of air 0°·3 below, and R 2·20 in. below, averages. Bright sunshine 137 hours.

TRINIDAD.—R 1·48 in. below 43 years average.

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RAIN GAUGE EXPOSURE IN THE TRANSVAAL.

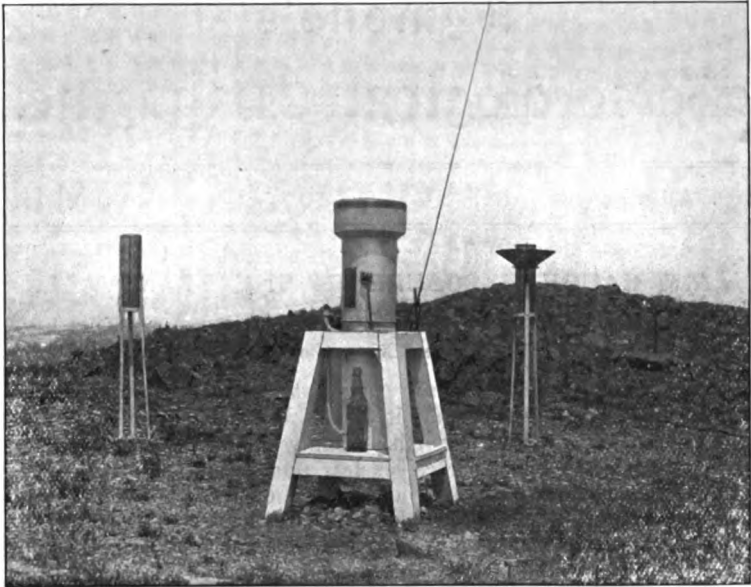
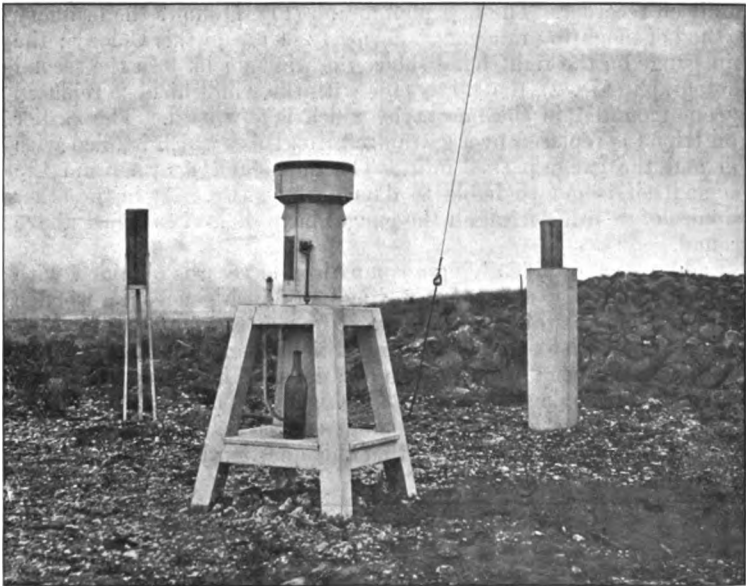
By R. T. A. INNES,

Director of the Transvaal Meteorological Department.

ONE of the standard 5-inch rain gauges at the Johannesburg Observatory is situated on the summit of the Witwatersrand ridge and another in the valley to the north, but only 200 yards or so distant.* The summit gauge always receives less rain than the valley gauge, and it was determined to find out what the effect of a wind-shield on a gauge on the summit would be. Dr. Shaw sent out a wind-shield 18 inches in diameter, and this was put on another gauge erected on the summit. These two gauges have always received the same amount of rainfall, as the accompanying Table which follows show. The photographs on the next page show the rain gauges on the summit. The rain gauge in the foreground is an 11½-inch Halliwell recorder. The first photograph (Fig. 1) shows the ordinary method of mounting rain gauges formerly in use in this Colony; the rain gauge on the right hand shows the wind-shield. In the second photograph (Fig. 2), the rain gauge with the wind-shield is replaced by one mounted in the new style, which is now used. The earlier iron tripod is replaced by a galvanized iron tube, which is filled with soil and the gauge packed in it. The tube stand is firmer and the gauge itself is not so liable to damage by cattle. As in the other colonies of South Africa, all the gauges have their rims 4 feet above ground.

I add a second table giving a comparison of records obtained with a 5-inch standard gauge on a tripod and an 8-inch gauge on a wooden stand at Heidelberg in this Colony. The gauges are only a few feet apart and have an identical exposure. Slight changes in their relative positions have been made on two occasions. The advantage of the more cumbersome and expensive 8-inch gauge is not apparent. The relative capital cost of an 8-inch gauge erected in this Colony is five times that of a 5-inch gauge, so that this question has its importance where funds are limited.

* See this Magazine, Vol. 40 (1905), p. 203.

RAIN GAUGE EXPOSURE IN THE TRANSVAAL.**FIG. 1.****FIG. 2.**

*Rain Gauges at Observatory, Johannesburg * (all 5 in. gauges).*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	TOTAL.
1905-6.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Summit.....	...	·06	·23	·83	6·04	3·99	3·81	8·54	3·39	·88	·11	...	27·90
Summit (with wind shield).....	}				5·88	3·98	3·80	8·56	3·39	·88	·12	...	—
Valley.....		·08	·29	·92	6·76	4·52	4·04	9·00	3·71	·95	·13	...	30·40
1906-7.													
Summit.....	...	...	·51	4·97	5·34	4·59							—
Summit (with wind shield).....	}		·55	4·97	5·08	4·52							—
Valley.....		...	·55	5·31	5·69	4·88							—

*Rain Gauges at Heidelberg, Transvaal.**

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	TOTAL.
1904-5.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
8 in. gauge..	...	·06	·20	1·56	6·45	3·27	5·79	5·97	3·01	2·26	·26	...	28·85
5 in. gauge..	...	·06	·20	1·54	6·50	3·30	5·83	5·91	2·97	2·27	·29	...	28·87
1905-6.													
8 in. gauge..	...	·28	·38	·27	6·70	4·99	1·37	5·98	3·40	·71	·19	...	24·42
5 in. gauge..	...	·29	·55	·27	6·95	4·98	1·34	5·95	3·38	·71	·17	...	24·57

* The meteorological year in the Transvaal is reckoned from July to June.

THE BRITISH WEATHER REPORTS.

WITH the beginning of the present year various changes appeared in the Weather Reports issued by the Meteorological Office, which cannot fail to increase their utility to the student as well as to the practical man who has learned how to apply the facts collected and published at the public expense to his own advantage.

We propose here to describe briefly the Daily, Weekly, and Monthly Weather Reports, in their present form, hoping that the public interested in Meteorology may thus be helped to realize more fully than we fear they now do, the completeness and promptitude with which this national work is carried on.

The *Daily Weather Report* is a four-page quarto sheet, issued daily at 2 p.m., after which hour it may be purchased for one penny at the Meteorological Office, 63, Victoria Street, or at the bookstalls in the railway stations at Victoria, Charing Cross, King's Cross, St. Pancras and Euston. We do not remember that we have ever had the *Daily Weather Report* thrust upon our attention at any of the railway stations in question; but at least it may be had there for the asking, which is more, we doubt, than can be said for this Magazine. The *Daily Weather Report* is sent post free to any address for

£1 per annum, and is usually delivered in London between 4 and 5 p.m.

The front page of the Report is occupied with observations of barometer, thermometer, wind, and weather, on the previous evening and on the morning of the day of publication, together with the maximum and minimum temperatures, weather, sunshine, and rainfall at 27 stations in the British Isles, at 31 stations on the continent of Europe, and at 6 in the islands of the North Atlantic, 64 stations altogether.

The last page of the Report contains explanatory notes for the first page, and a quantity of additional information, including figures for the previous day at 24 places in England and Wales, chiefly health resorts, and at 19 foreign stations, going as far afield as St. Petersburg, Malta, Algiers and Madeira. There is also a space neatly ruled off for "Wireless telegrams from ships of H.M. Navy," and this will no doubt be filled in the future, though so far no wireless messages have appeared.

The two inner pages of the Report are devoted to maps, notes, and forecasts. The first map has been extended beyond the limits imposed in previous years, so that now it includes the whole of Western Europe and a strip of the North Atlantic, which allows Iceland on the north, and the Azores on the south, to appear in their proper positions. Observations from the Azores have appeared in the Report for some time, but the inclusion of the data from Iceland and the Färoes is a triumph of the current year, and a most valuable result of the new Iceland cable. The Azores are separated from Europe by too great an extent of sea to allow the data to be used in drawing the isobars which depict the daily distribution of pressure, but Iceland is brought so near to Britain by the convenient stepping stones of Färoe and Shetland, that we now find on the daily weather chart a close approximation to the state of things in the great cyclone track that runs from south-west to north-east, just north of Scotland, and controls our weather to a great extent. It is too soon yet to say how far the new data will increase the accuracy of the forecasts; but they certainly improve the basis on which the forecasts are made. One of the most impressive results is the emphasis with which the new chart expresses the range of pressure that may be experienced. For example, the chart of Wednesday, 20th February, shows a depression over the south of Norway, with a minimum reading of 27.65 in., and a high-pressure area over Portugal with 30.44 in., the total range of pressure in 1400 miles being 2.79 in., or within a quarter of an inch of three inches. The steep gradients and the slow movement of this storm centre shown by the comparison of the charts for several successive days, explain the furious force and the extraordinarily long continuance of the gale which wrecked the Great Eastern Railway steamer *Berlin*, off the Hook of Holland, on the morning of the 21st, and postponed the rescue of the last surviving passengers for 36 hours.

A second large map shows the 8 a.m. distribution of temperature and weather, and small maps show the conditions at 8 a.m. and 6 p.m. on the previous day. The forecast districts are shown on a small map and the storm signals which were flying at the time of publication are indicated on this map. It is a significant tribute to the advance of geographical education that so much important information is presented by a government institution in a cartographic form without the use of words.

The *Weekly Weather Report* is a quarto document of 8 pages, price 6d., or post-free for a year £1 10s., and is issued on the Thursday of the week following that to which it refers. This Report is now in its thirtieth year, but the current volume inaugurates a series of improvements which greatly add to its value. The first page consists of general remarks on the week, with notes on the season and on the past four seasons, the elements referred to being weather, temperature, mean temperature of the sea, rainfall, bright sunshine, barometer and wind. Warmth for each of the twelve forecasting districts is characterised in a tabular summary as Very Unusual, Unusual, Moderate, Deficient, Very Deficient; rainfall similarly as Light, Moderate, Heavy; sunshine as Scanty, Moderate, Abundant. The summary of the thirteen weeks of winter in each of the 12 divisions is given in the form "Rainfall 4*2" where the heavy figure is the number of weeks of heavy rain, the light figure the number of weeks of light rain, the missing weeks representing the number with moderate rain. The definition of the characteristic terms must represent a great deal of thought and calculation. The week's warmth is called "unusual" or "deficient" if it is so much above or below the average for the time of year that in the long run it is likely to occur for that week only once in three years, and "very" is prefixed if it is likely to occur for that week only once in twelve years. Otherwise it is called moderate. Exactly similar definitions are assigned to the terms used for rainfall and sunshine, the whole system being based on the principle of the relative frequency of the values which occur. The idea seems to us a happy one, as it facilitates the comparison of different periods or seasons over considerable areas.

The second page gives for the week, the season and the year, so far as the latter have advanced, the temperature, accumulated number of day-degrees, rainfall and sunshine of each of the twelve divisions; the figures for each of the stations used to obtain the means (90 in all) being given on the third page. Some of the records are contributed by the Royal Meteorological Society and others by the Scottish Meteorological Society, these being duly distinguished from the records of the official stations.

The fourth page contains two Tables, one of grass minimum temperatures and of soil temperatures at depths of 1 foot and 4 feet; the other the highest, lowest and mean temperature of the sea taken twice daily by the coastguards at 21 stations round the British Isles.

Local circumstances make this Table of somewhat unequal value, but it at least calls attention to the importance of considering the sea as well as the land surface in the study of atmospheric conditions.

The remainder of the Report is occupied by three maps for each of the seven days of the week, giving respectively the temperature and weather at 8 a.m., the barometer and wind for 8 a.m. and 6 p.m. They are, in fact, a revised and reduced copy of the maps published in the *Daily Weather Report*. Brief explanatory remarks on the weather, temperature, wind and barometer for each day are added.

Finally, there is a summary of the week's observations on temperature, humidity and wind-velocity in the upper air, as ascertained by the ascent of kites or balloons at various stations, especially Brighton, Pyrton Hill on the northern slopes of the Chilterna, Ditcham Park on the South Downs and sometimes the Manchester University station in Derbyshire.

For many years it was the custom to issue a Monthly Supplement to the *Weekly Weather Report*, but with the first month of 1907 this has assumed the more elaborate form of a *Monthly Weather Report*, consisting of 8 quarto pages, to be published before the end of the next following month, and sold at 6d. per copy or 6s. 6d. per annum post free.

The first page gives a summary of the result of observations for the month, with special reference to pressure, the tracks of depressions, the occurrence of anticyclones, wind, temperature, rainfall, sunshine and observations in the upper air. The next five pages are devoted to a very complete summary of the observations at 123 stations in the British Isles and less complete statistics for 47 more. The seventh page contains notes on the statistical Tables and special information regarding special phenomena; thus in the Report for January there is a discussion of the remarkable high-pressure system which prevailed over northern Europe from the 20th to the 26th.

The last page is occupied by four maps expressing in considerable detail the average or general conditions of the month. The first deals with pressure and wind, showing the average for the particular month and the average for that month for 35 years. The second map shows the movements of the barometric depressions for the month, the tracks of each cyclone joining the positions of the centre at 8 a.m. and 6 p.m. on the days of its existence. The third map shows the mean temperature of the month by isotherms drawn for each degree. The fourth map represents the distribution of rainfall for the month and is a new departure in so far as it is prepared by the British Rainfall Organization from about 700 monthly returns. The large number of observations makes it possible to draw lines showing the areas with less than an inch, between 1 and 2 inches, between 2 and 3, between 3 and 4, between 4 and 6, between 6 and 8, between 8 and 10 and over 10 inches; and as each succeed-

ing line is made thicker than the line of lower value the gradation of rainfall is clearly shown. It is, we are sure, a pleasure to all the unofficial observers of rainfall to know that their work is accepted by the Meteorological Office as of public utility, and the full title of the Monthly Weather Report recognizes the voluntary assistance in its wording—"Monthly Weather Report of the Meteorological Office. Summary of Observations compiled from the returns of official stations and volunteer Observers in the United Kingdom, with a Chart contributed by the British Rainfall Organization. Issued by the Authority of the Meteorological Committee." Such co-operation between the various meteorological agencies in the country cannot fail to have a stimulating effect on the advancement and the wider understanding of meteorology.



QUALITATIVE ANALYSIS OF CURVE DIAGRAMS.

By WILHELM KREBS, Hamburg.

THE following statements show a simple method for getting numerical values from the comparison of curve diagrams, which I have also applied to other statistical investigations. It deals only with the general direction of the oscillations, i.e., whether the curve is rising or falling, and can therefore be said to be a qualitative analysis of such diagrams. It would, if applied to the "barometric see-saw," enable one to get numerical values for drawing "isophasms" of pressure and for supplying the place of such doubtful signs as +?, —?, + and +?.

I choose another actual example as an illustration.

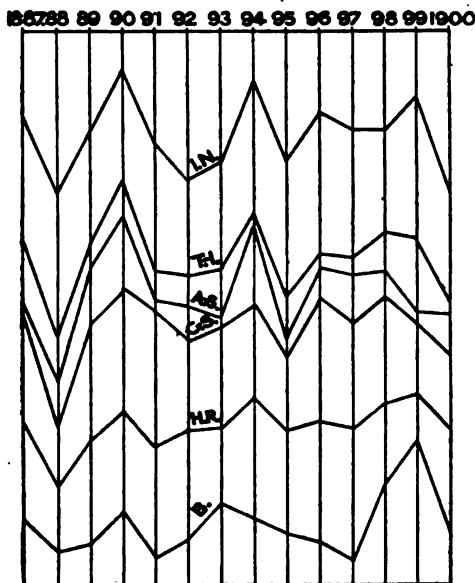
In the following, diagrams are compared from 1887 to 1900.

I.—The mean oscillation of the sea-level of the Baltic on the Swedish shores (B.), after Rosén ;

II.—Five other oscillations regarding the quantities of heat in the North Sea near Horns Reef (H.R.), the differences of air-pressure between Copenhagen and Stykkisholm, Iceland (C.S.), between the Azores and Stykkisholm (A.S.), between Toronto and Ivigtut, Greenland (T.I.), and the quantities of Arctic ice near Newfoundland (I.N.), after Meinardus.

The *qualitative analysis* is given in extenso here :—

	1887	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	1900
B.	down	up	up	down	up	up	down	down	down	down	up	up	down	
H.R.	d.	u.	u.	d.	u.	u.	u.	d.	u.	d.	u.	u.	d.	
C.S.	d.	u.	u.	d.	d.	u.	u.	d.	u.	d.	u.	d.	d.	
A.S.	d.	u.	u.	d.	d.	d.	u.	d.	u.	d.	u.	d.	d.	
T.I.	d.	u.	u.	d.	d.	u.	u.	d.	u.	d.	u.	d.	d.	
I.N.	d.	u.	u.	d.	d.	u.	u.	d.	u.	d.	0	u.	d.	



Agreements with H.R.

	Number	%
B.	11 : 13 =	85
C.S. ...	11 : 13 =	85
A.S. ...	10 : 13 =	77
T.I. ...	11 : 13 =	85
I.N. ...	11.5 : 13 =	89

1. The oscillations of water-temperature near Horns Reef (H.R.) show an important accordance (85%) with those of the Baltic sea-level (B.)

2. They show the same accordance (85%) with the differences of pressure for Toronto-Ivigtut (T.I.) and Copenhagen-Stykkisholm (C.S.)

3. They show a less agreement (77%) with the differences of pressure Azores-Stykkisholm (A.S.)

4. They show a very important agreement (89%) with the oscillations of Arctic ice near Newfoundland (I.N.)

The following conclusions seem to be justified :—

The water-temperature near Horns Reef, the sea-level of the Baltic, and the quantities of Arctic ice near Newfoundland, depend in a high degree on the same causes (1, 4).

The mean atmospheric circulation over the northern Atlantic, especially in the winter half of the year, forms an important part of these causes (2).

It seems possible that the temperature of the eastern part of the North Sea is changed indirectly by the circulation causing the colder surface-water of the Baltic (mean difference from the surface temperature of the North Sea, 4.5° F.) to be more or less effective in cooling the surface of the North Sea.

RAIN-MAKING EXPERIMENTS IN THE KLONDIKE.

WE have pleasure in reprinting from *The Times* of February 11th the following statement as to the "rain-making" experiments referred to in Vol. 41, p. 115:—

Owing to the scarcity of water for hydraulic mining in the Klondike district, the Government of Yukon Territory and a number of the largest mineowners and operators made, as reported some time ago in *The Times*, a contract with Mr. C. M. Hatfield, of Los Angeles, who had made many "rain-making" experiments in the arid parts of California. If he produced "a sufficient rainfall to ensure, as far as an ample rainfall would, a successful and prosperous summer in the placer mining industry," the fact to be determined by a board representing the various parties to the contract, he was to receive \$5,000 from the Government and \$5,000 from the miners; otherwise he was to receive the travelling and living expenses of himself and his assistant. The Commissioner administering the territory now reports that Mr. Hatfield "commenced his demonstrations on June 11th, on a high eminence called the 'Dome,' about 80 miles from Dawson. On Hunker, Sulphur, Gold Run and Dominion creeks the rainfall for June was above the average, but on Bonanza and Eldorado it was below normal. During the early part of July there was no increase over the average of former years. Accordingly, at a meeting of the aforesaid board, held at Dawson on July 23rd, it was decided that 'in the opinion of this committee the contract entered into on July [*sic.*] 10th, 1905, has not been carried out, and that Mr. Hatfield be notified that his contract is terminated.' A copy of this decision was immediately sent to Mr. Hatfield, who thereupon desisted from further experiments. The Government of the Yukon Territory paid \$1,153.05 to Mr. Hatfield in full settlement of its liability under said contract." The Commissioner also reports that agriculture is developing in the territory, and regulations have been made under which homestead land can be acquired on liberal conditions by *bona fide* settlers. Last summer enough ground was brought under cultivation in the Dawson district practically to supply the local demand for vegetables, and the Commissioner expects a large increase in the cultivated area this year.

WEATHER RECORDING.

By F. DRUCE.

FROM time to time there have appeared in the pages of this Magazine notes on the states of the sky and atmosphere as precursors of weather change.

There is, probably, no student of meteorology but has felt the great difficulty there is in describing adequately in his register the daily phenomena so far as they are not recorded instrumentally.

Some, *e.g.*, wind velocity and cloudiness, are referred to scales and notations—and this is so far satisfactory,—but there are many aspects of sky and atmosphere which cannot be thus dealt with, and are very difficult of description. In proof of this get a number of persons to write down their impressions of the weather of a particular day, and it is a safe assumption that their accounts will vary materially, not necessarily through inaccuracy of observation or the personal equation, but through the inadequacy of means of expression. The whole question is of little importance, no doubt, to a forecaster in a central office receiving telegrams from widely scattered districts,—it rather appeals to the “solitary observer” who is concerned to keep as accurate a register as possible, and one that will be of use, on reference, for forecasting purposes, both to himself and others.

To take a few instances :—(i.) The sky on a hot morning in late spring or summer is clear, except for a few small patches of cirro-cumulus cloud, the atmosphere is very hazy, and the wind is very light, from E.S.E. ; (ii.) The sky (again in summer) is quite covered with cirro-stratus cloud, which gradually assumes the appearance of fine net or gauze, while the atmosphere becomes thicker and thicker, not with fog or mist, but (if the expression may be used) with *damp*, the wind is E.N.E. ; (iii.) The sky is, again, overcast (with cloud much lower in level than in No. 2) and has the appearance of being underlaid with smoke, the wind is W.N.W. ; (iv.) The atmosphere is exceedingly clear in late spring, and the sky partly covered with small cumulus clouds, with hard edges, the wind is N.W. These instances, respectively, may be taken as fairly safe indications of (i.) a late afternoon thunderstorm with wind veering to S.W. ; (ii.) a steady persistent fall of rain, perhaps of an inch or more ; (iii.) intermittent drizzle or rain of little intensity, and (iv.) a backing of wind to S.W. and a gale and rain ; but although the observer has in this way done his best to record the prognostics, (and following weather) and he himself might be able to recognize the former, when recurring, with the recorded descriptions, it is doubtful whether another person taking up the register would gather at all clearly what was meant.

The matter is difficult, and it is not easy to point out any very practicable means of improvement. The connection of meteorology with the affairs of everyday life is, however, so obvious, that no apology should be needed for suggesting that, so far as the observer himself is concerned, a careful diary of his doings side by side with the weather record is of considerable use. The letter of Mr. Bonacina (Vol. 41, p. 192) provides an instance of this. In it he describes the state of the sky and the following weather near Sevenoaks, on November 3rd last. The present writer, who was on the other side of London on that day, on reading the letter, referred to his diary, and the events there recorded brought clearly to his recollection the state of the sky, the description of which in his

weather register, as a matter of fact, corresponded closely with that given by Mr. Bonacina.

A valuable aid to making an observer's record intelligible to others is to be found in photography—though it must be admitted that with the exception possibly of No. 4, the camera would have been useless in the instances given above. The importance of photography in this connection has already been pointed out in these pages (*e.g.*, Vol. 38, p. 80), and satisfactory pictures of many cloud forms can be made and annexed to the record, but, of course, the “general look” of the weather and “state of the atmosphere” cannot be recorded in this way. It seems that the best hope of improvement lies in increased care and intelligence, both in observing and in recording what is observed.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, February 20th, at the Institution of Civil Engineers, Great George Street, Westminster, Dr. H. R. Mill, President, in the chair.

Mr. Edward Mawley read his “Report on the Phenological Observations” made during 1906 by observers in various parts of the British Isles. The most noteworthy features of the weather of the phenological year ending November, 1906, as affecting vegetation, were the dry period lasting from the beginning of June until the end of September, and the great heat and dryness of the air during the last few days in August and the first few days in September. Wild plants came into flower in advance of their usual dates until about the middle of April, after which time they were late as a rule to about the same extent. Such early spring migrants as the swallow, cuckoo, and nightingale, reached these Islands somewhat behind their average dates. The only deficient farm crop, taking the country as a whole, was that of hay, all the others being more or less over average. The yield of apples was about average in all but the north of England and in Scotland, where there was a very scanty crop. Pears and plums were everywhere very deficient, whereas all the small fruits yielded moderately well. As regards the farm crops, the past year proved even more bountiful than 1905.

Mr. H. Mellish, Mr. J. E. Clark, Mr. F. C. Bayard, Mr. J. Hopkinson, Mr. W. W. Bryant and the President took part in the discussion, and Mr. Mawley replied.

Mr. R. Inwards read a paper on “The Metric System in Meteorology.” He stated that it was not his intention to discuss the general question of the advantages of the metric system over that in use by Britain and her Colonies and the United States of America, but to confine his remarks to the manifest advisability of all the meteorological observers upon the globe adopting some uniform system.

He then proceeded to show by a map how many countries have adopted the metric system in meteorology, and how many use the non-metric. He concluded by saying: "With confident expectation we may, I think, look forward to the time when the whole world will have but one system of meteorological calculation, and as the matter of reconstruction or alteration of some of the standards, units or zeros is now 'in the air,' it would give a good opportunity, if changes must be made, to adopt in England and America the same system which has been for so long a time in use on the Continent of Europe and over a great portion of the land surface of our planet."

In the discussion on this paper, Mr. H. Mellish, Mr. W. H. Dines, Mr. R. H. Curtis, Mr. W. W. Bryant, Mr. F. C. Bayard, Mr. W. Marriott and the President took part, and the general feeling appeared to be unfavourable to the adoption of the metric system by British meteorologists.

Mr. J. L. Adlercron, Mr. G. T. Derry, Mr. W. H. M. Jones, Capt. G. M. Keane, R.N., Mr. J. McEwan, Mr. A. Mudd, Mr. R. Nursey and Mr. A. B. Ogden were elected Fellows of the Society.

A RELATION BETWEEN RAINFALL AT YORK AND SOLAR CYCLES.*

By J. EDMUND CLARK, B.Sc.

WORKING with the 89 years of extant records at York (1811 to 1824 and 1831 to 1905), a very obvious contrast was noted between the August rainfall and that of the next two months. August was relatively wetter at times at and following solar quiescence, drier at and following solar activity.

The values for the annual rainfall and for each month were therefore compared with Wolf and Wolfer's sunspot values. Three years were taken about each of the six maxima and minima from 1831 to 1902, or 18 in all at each. The annual values showed 425·73 in. for the latter and 475·73 in., or 12 per cent. more, for the former. *Every* minimum, except that of 1879, produced less rain than the succeeding maximum. Nine of the months contributed to this; in August alone was there marked excess.

For the 18 years at minima the August rainfall was 59·78 in.; at maxima, 38·02 in., or an excess of $36\frac{1}{2}$ per cent. The values for September were 45·19 in. and 30·53 in.; for October, 49·61 in. and 35·62 in.

Again, for August and October the contrast is true of *each* decade, comparing the fall at each solar minimum with the following maximum. It is true, also, of the first four in September by nearly two to one. In the sixth the values are equal. That they are reversed

* Abstract of Paper read at the Meeting of the British Association at York, 1906.

in the fifth is not surprising, as September in the seventies gave a mean of 3.36 in., against 1.89 in. for the other 79 years.

We can accentuate the above contrast by taking the difference between the mean of September and October ($\frac{s+o}{2}$) and August (A); that is, by using the value $\frac{s+o}{2} - A$. The actual mean result is -0.26 in.

The resulting curve from taking the 3-bloxamed values year by year is strikingly analogous to the sunspot curve.

These year-by-year values were sorted out over a smooth 11-year cycle,* the first year (I.) corresponding to minimum and the sixth (VI.) to maximum sunspots.

This smoothing can be likened to the stretching round an 11-inch cup-rim of six rubber rings, ranging from 9 to 13 inches round, all marked in inches. "I." of each ring comes on "I." of the cup. On "VI." comes the actual year of sunspot maximum, ranging from "IV." to "VII." The rest are stretched or puckered over the values between.

The six sets were then combined and the mean taken for our formula $\frac{s+o}{2} - A$.

The resulting values give an unbroken curve practically identical with the sunspot curve. If the half-periods are taken, each is practically the same. So also if the unbloxamed values are used. This is shown in the subjoined Table.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
1831-1866—3-bloxamed ...	-1.3	-2.0	-1.3	-0.9	+0.1	+0.1	+0.1	+0.2	-0.1	-0.3	-1.2
1867-1903— " ...	-1.3	-0.6	-0.2	+0.3	+0.4	+1.0	+1.1	+0.6	+0.7	-0.0	-0.6
1831-1903— " ...	-1.3	-1.2	-0.7	-0.2	+0.3	+0.3	+0.6	+0.4	+0.3	-0.3	-0.9
1831-1903—un-bloxamed	-1.6	-1.0	-0.7	-0.3	+0.2	+0.6	+0.6	+0.6	+0.3	+0.0	-1.0
1831-1901—Sunspots	6	17	37	62	78	115	86	69	41	25	14

Similar results are found for other British stations examined, including the long-period records from Exeter (87 years), Rothsay (103) and London (106). If the same 70 years are taken, the resemblance is still closer. The minimum at I. occurs even for the longer records. Uppingham also (1736-98) is similar, though the extremes fall at II. and VIII., accentuating the tendency to "lag."

For York rain days $\frac{s+o}{2} - A$. ranges from -0.8 at I. to $+2.2$ days at V. and 1.9 as a "hump" at X. The temperature range is from -6.9° at II. to -9.0° at V., but the curve is more irregular.

The two 35-year periods also yield similar interesting results. This is more marked when the 11-year cycles are eliminated from the rainfall and sunspot curves.

* See *Symons's Meteorological Magazine*, February, 1904.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

AURORA BOREALIS ON FEBRUARY 9th.

LAST night, after dark, noticing that the northern sky was very much lighter than it ought to have been, I suspected that an aurora was the cause. The early part of the phenomenon was much obscured by fog, but soon after 8 p.m. the fog dispersed, revealing a rather fine display of aurora borealis for the south of England. The arc was broad and extensive, and of varied hues of rose red and gold; the streamers were sharply defined, and extended nearly half way across the firmament, whilst the coruscations were at times quite brilliant.

L. C. W. BONACINA.

Clandon, Surrey, February 10th, 1907.

The following notes of the auroral display of February 9th may be of interest.

8.15 p.m.—The aurora appeared.

8.20.—Faint streamers of light, extending up from N. by W. horizon. A large patch of a vivid scarlet colour appeared over the western horizon at an elevation of 35°.

8.35 to 8.45.—The streamers of light replaced by waves or pulsations of light passing across the sky from N. by W.

8.50.—Re-appearance of streamers of light, one of great brilliancy extending from N. and W. horizon, through Cassiopea well towards the zenith. Cessation of pulsations of light.

8.55.—Streamers disappear, faint pulsations of light again noticeable, as waves crossing the sky.

The display was followed by the appearance of a bank of black cloud (fog), 10° in elevation, lying off the N. horizon, at times cirrus clouds appeared above lower clouds.

D. WILSON-BARKER.

Greenhithe, February, 1907.

AUDIBLE METEORS.

SINCE I wrote the letter published in your February number, I have read Mr. E. Huntley's note in your November number. The meteor he saw on August 7th, 1906, was evidently a Perseid, belonging to the great annual shower of August. Several other bright Perseids were observed at various times and by different persons on the date mentioned. It is in the highest degree probable that the sound heard by Mr. Huntley had no connection whatever with the meteor seen at about the same time. The average heights of the Perseids are from 80 miles at beginning to 54 miles at ending, and sound

reaching us from such objects (even when crossing the zenith of the observer) must necessarily occupy from about $4\frac{1}{2}$ to $6\frac{1}{2}$ minutes in transmission.

Moreover the members of this system do not apparently belong to the detonating class, for they very rarely furnish audible sounds. I cannot recall a single instance of the kind supported on ample evidence—of 2990 Perseids recorded by the writer at Bristol during the years 1869–1906, not one appears to have occasioned a well-marked detonation.

Mr. J. G. Wood seems to be indiscriminately confusing bright meteors with electrical phenomena, sometimes known as “ball-lightning.” There is a wide distinction between meteoric fireballs and electrical fireballs. I quite agree with Mr. C. L. Brook's interesting remarks on the subject of audible meteors. There is no question that sounds of various character (heard either instantaneously with or following meteoric outbursts) are frequently attributed to meteors when no real association exists. Some people are so peculiarly sensitive to impressions, imaginary and illusory, that it is quite customary for them to hear a hissing noise as a meteor shoots along the sky. One pretty well known astronomical observer ascribes a detonation to every conspicuous meteor which comes under his notice. On the disappearance of an object he listens attentively for a long time afterwards, and generally hears something within half-an-hour (he lives in a populous city), which he confidently connects with the meteoric explosion. But his conclusions have been proved to be erroneous in several cases where duplicate observations enabled the real paths and distances of the objects to be ascertained.

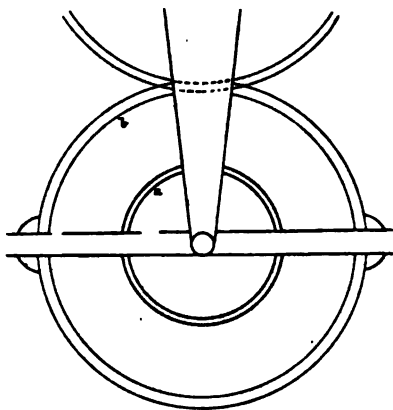
As good typical examples of large and really detonating fireballs, those of November 23rd, 1877, and January 25th, 1894, may be mentioned. But the hissing of *ordinary* meteors and shooting stars, sometimes said to occur simultaneously with their flights across the sky, is an illusion. The laws of acoustics, even if no other negative evidence were available, forbid our entertaining the idea that the sound of meteoric concussions travels with special velocity. It is far easier to believe that observers have made mistakes, and there is an abundance of evidence affording significant indication, if not convincing proof, that this is the correct explanation.

W. F. DENNING.

February 20th, 1907.

SOLAR HALO.

THE sketch shows a solar halo seen from Epsom Downs during the afternoon of February 6th last. The sky at the time of observation was covered with cirro-stratus of varying density, the sun shining through with a pale greyish gold light. The inner halo (*a*) was



(*a* and *b*) were invisible through this beam, but the partial halo at the top shone through, although very faintly. The phenomenon varied both in intensity of colour and completeness of outline.

SPENCER C. RUSSELL, F.R.Met.Soc.

Epsom, February 20th, 1907.

SOLAR ACTIVITY AND WEATHER.

IN your January issue (Vol. 41, p. 232), under "The Sunspot Question," a correspondent writes to point out that Professor Bigelow's results, according to a review in the November issue, are at variance with those of certain other investigators.

Professor Bigelow indicates that the solar prominences, not the spots, are the true register of the variable solar activity which synchronizes with weather conditions, and that, whereas the 3-year period in the prominence-frequency is more marked than the 11-year period in accordance with a more strongly-marked 3-year period in the variations of atmospheric pressure and temperature over the Earth's surface, the 11-year period in the frequency of spots is more conspicuous than the 3-year period. It is probably here that the discrepancy referred to by your correspondent arises.

L. C. W. B.

January 24th, 1907.

TROPICAL RAINFALL.

A FACT which came to my knowledge to-day in an official Report from the Estate may be of interest to you. At Inrugalla Estate, Dolosbagie District, Central Province Ceylon, on December 8th, 1906, 6.37 in. of rain fell between 4.30 and 5.30 p.m. Bridges were carried away and much damage done.

N. W. GRIEVE.

Groombridge, Jan. 3rd, 1907.

THE LANDER SELF-RECORDING RAIN GAUGE.

SEVERAL of your readers having gathered a somewhat incorrect impression about the clock from your otherwise very favourable account of my rain gauge in your last issue, perhaps you will kindly allow me to say that the clock and gear is the well-known barograph pattern, by one of the very best makers, and is exactly the same as supplied by a number of well-known makers in their barographs, thermographs, and other self-recording instruments. I have tried a great number of clocks of various patterns, with lever and cylinder escapements, but the one now supplied has proved itself by far the best. If it is possible to get a better one I should be glad to obtain a sample from the makers. Nothing short of a chronograph movement, with delicate temperature compensation, would keep *absolutely accurate* time when exposed out of doors, to temperatures which vary from 20° to 100° F., but such a movement is quite unnecessary and would cost far more than the price of the whole instrument.

I may say that about a dozen recent Kew certificates for my instruments fitted with these clocks state that "clock rate and time scale were found to be satisfactory."

A. LANDER.

METEOROLOGICAL NEWS AND NOTES.

MR. A. LAURENCE ROTCH, the well-known founder and Director of Blue Hill Meteorological Observatory in Massachusetts, has been appointed Professor of Meteorology in Harvard University. The Blue Hill observations have been published in the *Annals of the Harvard College Observatory* for many years.

THE ROYAL METEOROLOGICAL SOCIETY at its meeting on Wednesday, 20th March, will be addressed by Major B. F. S. Baden-Powell, in a lecture on "The Exploration of the Air," illustrated by models and lantern slides, and dealing, we understand, with recent advances in the direction of obtaining observations in the free air by means of flying machines. It has been announced that the annual dinner of the Society will be held at the Trocadero Restaurant, on June 18th, and as one of the afternoon meetings of the Society takes place on the following day the opportunity is one likely to attract Fellows living in the country who have few opportunities of meeting each other.

A COURSE OF FIVE LECTURES on Dynamical Meteorology was commenced at University College, Gower Street, by Dr. W. N. Shaw, in his capacity as Reader in Meteorology in the University of London, on Friday, 22nd February. The course, for which no fee is charged, was unfortunately interrupted by the illness of the lecturer, but continues on Fridays, at 5 p.m., after Easter.

TEMPERATURE FOR FEBRUARY, 1907.

STATION.	COUNTY.	Lat. N.	Long. W. [° E.]	Height above Sea. ft.	TEMPERATURE.				No. of Nights at or below	
					Max.		Min.		Shade.	Gm.
					°	Date.	°	Date.		
Camden Square.....	London.....	51 32	0 8	111	52·0	17	23·4	24	15	24
Tenterden.....	Kent.....	51 4	0 41	190	53·0	17, 28	21·0	23	16	28
West Dean.....	Hampshire.....	51 3	1 38	137	51·0	15, 17	15·0	2, 3	17	23
Hartley Wintney.....	".....	51 18	0 53	222	54·0	18, 28	16·0	2	17	28
Hitchin.....	Hertfordshire.....	51 57	0 17	238	51·0	17	21·0	8, 23	19	...
Winslow (Addington).....	Buckinghamsh. r.	51 58	0 53	309	52·0	17	18·0	2, 23	19	21
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	0 40	226	54·5	28	17·0	8	16	...
Brundall.....	Norfolk.....	52 37	1 26	66	54·4	28	20·6	8	17	21
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	50·8	17	18·3	3	16	20
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	53·4	9	24·6	24	9	19
Polapit Tamar (Launceston).....	".....	50 40	4 22	315	52·6	15	18·1	3	14	23
Bath.....	Somerset.....	51 23	2 21	67	53·0	19, 27	17·0	3	16	...
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	54·0	17	22·0	2, 3	15	...
Church Stretton (Woolstaston).....	Shropshire.....	52 35	2 48	800	49·5	27	15·0	23	27	...
Bromagrove (Stoke Reformatory).....	Worcestershire.....	52 19	2 4	225	49·0	15†	13·0	2	...	22
Boston.....	Lincolnshire.....	52 58	0 1	25	53·0	27	21·0	2	19	...
Workshop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	55·8	15	17·1	3	19	26
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	53·0	15‡	16·0	2	20	...
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	50·8	15	23·0	2	17	22
Wetherby (Ribston Hall).....	Yorkshire, W. E.	53 59	1 24	130	...	...	...	...	...	...
Arnccliffe Vicarage.....	".....	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park).....	" E. R.	53 45	0 20	6	55·0	15§	19·0	3	15	26
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	53·6	27	18·3	1	18	...
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	51·8	15	22·2	2	11	14
Haverfordwest (High Street).....	Pembroke.....	51 48	4 58	95	52·0	27	18·0	1, 2	...	...
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	52·0	15, 19	28·2	3	8	...
Llandudno.....	Carnarvon.....	53 20	3 50	72	52·0	25	15·0	1, 6	17	...
Cargen (Dumfries).....	Kirkcudbright.....	55 2	3 37	80	55·0	27	16·0	5	22	26
Lilliesleaf (Riddel House).....	Roxburgh.....	55 31	2 46	550	52·1	27	21·3	1	17	19
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	54·0	18	19·0	4	13	...
Colmonell (Clachant).....	Ayr.....	55 8	4 54	140	51·0	27	20·0	5	16	24
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	48·0	27	22·0	21, 22	19	20
Tighnabruaich.....	Argyll.....	55 55	5 14	50	51·0	27	...	...	...	...
Mull (Quinish).....	".....	56 36	6 13	35	55·5	27	19·5	6	17	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	...	...	...	...	...	...
Braemar.....	Aberdeen.....	57 0	3 24	1114	59·0	26	24·0	5, 12	21	...
Aberdeen (Cranford).....	".....	57 8	2 7	120	...	...	...	...	...	...
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130‡	...	...	...	...	...	...
Loch Torridon (Bendamp).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	52·0	15	23·0	1	15	...
Castletown.....	Caithness.....	58 35	3 23	100	50·0	15, 28	23·0	11, 21	23	25
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	59·0	16	27·0	5, 23	...	...
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	53·0	17	24·0	22	12	...
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	50·0	14	24·0	7	15	...
Carlow (Browne's Hill).....	Carlow.....	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	55·7	15	28·4	5	14	18
Ballinasloe.....	Galway.....	53 20	8 15	160	...	...	...	...	...	...
Clifden (Kylmore House).....	".....	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscroe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...	...
Seaford.....	Down.....	54 19	5 50	180	51·0	15	26·0	5	21	18
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	52·0	15	25·0	5	16	...

† and 16, 17, 27

‡ and 27, 28.

§ and 25, 28

RAINFALL FOR FEBRUARY, 1907.

RAINFALL OF MONTH.						RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
rer. 0-99.	1907.	Diff. from Av. in.	% of Av.	Max. in 24 hours.	No. of Days	Aver. 1870-99.	1907.	Diff. from Aver. in.	% of Av.		
n.	in.			in. Date.		in.	in.			in.	
62	1.17	— .45	72	.38	10	13	3.51	2.08	— 1.43	59	Camden Square
85	1.42	— .43	77	.42	12	11	4.21	2.42	— 1.79	57	Tenterden
27	1.60	— .67	70	.51	12	12	4.95	2.45	— 2.50	50	West Dean
06	1.50	— .56	73	.44	19	8	4.45	2.16	— 2.29	49	Hartley Wintney
54	1.22	— .32	79	.42	12	15	3.35	2.19	— 1.16	65	Hitchin
73	1.11	— .62	64	.32	12	12	3.78	2.07	— 1.71	55	Addington
55	1.53	— .02	99	.37	10	16	3.25	2.82	— .43	87	Westley
49	1.77	+ .28	119	.33	12	21	3.16	3.49	+ .33	110	Brundall
11	1.71	— 1.40	55	.36	11	13	7.01	3.88	— 3.13	55	Winterbourne Stptn
87	1.53	— 1.34	53	.58	11	11	6.06	3.26	— 2.80	54	Torquay
84	1.71	— 1.13	60	.44	19	16	6.71	4.44	— 2.27	66	Polapit Tamar
12	1.26	— .86	59	.32	12	12	4.64	2.49	— 2.15	54	Bath
13	1.36	— .77	64	.25	11	14	4.59	2.66	— 1.93	58	Stroud
27	1.65	— .62	73	.35	12	16	5.08	3.41	— 1.67	67	Woolstaston
63	.64	— .99	39	.13	8	10	3.54	1.47	— 2.07	42	Bromsgrove
55	1.14	— .41	74	.50	12	11	3.14	1.92	— 1.22	61	Boston
58	1.47	— .11	93	.47	12	17	3.32	2.22	— 1.10	67	Holsock Priory
66	1.76	+ .10	106	.38	12	15	3.61	2.91	— .70	81	Derby
67	2.48	— .19	93	.63	11	13	6.05	4.78	— 1.27	79	Bolton
63	1.80	+ .17	110	.38	12	14	3.52	3.10	— .42	88	Ribston Hall
74	5.58	+ .84	118	1.87	16	14	11.07	9.04	— 2.03	82	Arneliffe Vic.
86	1.54	— .32	83	.71	12	15	3.66	2.55	— 1.11	70	Hull
58	1.25	— .33	79	.33	12	15	3.54	1.73	— 1.81	49	Newcastle
64	8.69	— 2.95	75	2.45	16	13	26.35	14.70	— 11.65	56	Seathwaite
13	1.78	— 1.35	57	.50	19	12	6.98	4.57	— 2.41	65	Cardiff
70	2.30	— 1.40	62	.64	11	14	8.83	4.58	— 4.25	52	Haverfordwest
03	2.62	— .41	86	.44	11	18	6.90	5.96	— .94	86	Gogerddan
97	1.55	— .42	79	.37	18	15	4.54	2.97	— 1.57	65	Llandudno
62	2.97	— .65	82	.94	10	9	8.16	4.99	— 3.17	61	Cargen
41	1.09	— 1.32	45	.56	19	13	5.01	2.13	— 2.88	43	Riddell House
...	1.01	...	...	.40	19	10	...	1.85	...	...	Edinburgh
67	2.60	— 1.07	71	.43	10	10	8.19	5.10	— 3.09	62	Colmonell
53	2.68	+ .15	106	.65	16	13	5.78	4.54	— 1.24	79	Glasgow
57	4.64	+ .07	102	.70	19	17	10.43	8.74	— 1.69	84	Tighnabruaich
50	4.52	+ .02	100	.66	7	22	10.35	9.11	— 1.24	88	Quinish
10	1.00	— 1.10	48	.40	19	12	4.20	1.95	— 2.25	46	Dundee
70	2.36	— .34	87	...	...	...	5.61	3.97	— 1.64	71	Braemar
43	1.87	— .56	77	.36	12	16	4.75	3.76	— .99	79	Aberdeen
86	2.03	+ .17	109	.66	19	9	4.00	3.73	— .27	93	Cawdor
89	7.07	+ 2.18	145	1.21	16	13	11.52	13.43	+ 1.91	117	Invergarry
77	11.93	+ 5.16	176	1.09	20	23	15.52	21.41	+ 5.89	138	Bendamp
39	3.16	+ .77	132	1.04	19	11	5.01	7.28	+ 2.27	145	Dunrobin Castle
...	3.01	...	...	.70	19	21	...	6.90	...	...	Castletown
44	2.38	— 3.06	44	.43	12	19	12.01	4.78	— 7.25	40	Killarney
30	1.87	— 1.43	57	.59	11	15	7.36	2.66	— 4.70	36	Waterford
19	2.21	+ .02	101	.59	11	15	5.17	3.65	— 1.52	71	Hurdlestown
61	...	...	...	...	...	...	5.76	...	...	...	Carlow
98	1.30	— .68	66	.38	11	14	4.14	1.73	— 2.41	42	Dublin
48	...	...	...	...	...	...	5.97	...	...	...	Ballinasloe
08	4.46	— 1.62	73	.72	8	16	13.94	8.29	— 5.65	59	Kylemore House
01	3.93	— .08	98	.37	19	24	9.01	7.23	— 1.78	80	Ennisce
97	2.04	— .93	69	.45	19	16	6.60	3.43	— 3.17	52	Seaforde
73	4.11	+ 1.38	151	.85	20	20	6.29	7.58	+ 1.29	121	Londonderry
40	2.72	+ .23	109	.35	16	18	5.83	4.97	— .86	85	Omagh

SUPPLEMENTARY RAINFALL, FEBRUARY, 1907.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	2.00	XI.	Rhayader, Tyrmynydd	...
"	Ramsgate, West Cliff Villas	1.26	"	Lake Vyrnwy	4.41
"	Hailsham	1.55	"	Llangyhanaf, Plas Draw	1.75
"	Crowborough, Uckfield Lodge	2.23	"	Criccieth, Talarvor	1.95
"	Osborne, Newbarn Cottage	1.37	"	Llanberis, Pen-y-pass	2.23
"	Emsworth, Redlands	1.44	"	Lligwy	1.76
"	Alton, Ashdell	2.01	"	Douglas, Woodville	2.59
"	Newbury, Welford Park	1.70	XII.	Stoneykirk, Ardwell House	1.75
III.	Harrow Weald, Hill House	1.31	"	Dalry, The Old Garroch	5.03
"	Oxford, Magdalen College	1.04	"	Langholm, Drove Road	3.28
"	Bloxham Grove	1.18	"	Moniaive, Maxwellton House	3.35
"	Pitsford, Sedgebrook	1.25	XIII.	N. Eak Reservoir [Penicuik]	3.10
"	Huntingdon, Brampton	1.00	XIV.	Maybole, Knockdon Farm	2.10
"	Wisbech, Bank House	1.22	XV.	Campbeltown, Witchburn	2.75
IV.	Southend Water Works	1.20	"	Inverary, Newtown	7.87
"	Colchester, Lexden	.83	"	Ballachulish House	9.73
"	Newport, The Vicarage	1.32	"	Islay, Eallabus	4.97
"	Rendlesham	.65	XVI.	Dollar Academy	3.67
"	Swaffham	1.32	"	Loch Leven Sluice	2.40
"	Blakeney	1.35	"	Balquhider, Stronvar	7.68
V.	Bishops Cannings	1.24	"	Perth, Pitcullen House	1.46
"	Ashburton, Druid House	2.60	"	Coupar Angus Station	1.26
"	Okehampton, Oaklands	2.06	"	Blair Atholl	3.47
"	Hartland Abbey	1.63	"	Montrose, Sunnyside Asylum	2.21
"	Lynmouth, Rock House	2.39	XVII.	Alford, Lynturk Manse	1.61
"	Probus, Lamellyn	1.31	"	Keith Station	1.66
"	Wellington, The Avenue	1.53	XVIII.	N. Uist, Lochmaddy	3.15
"	North Cadbury Rectory	1.03	"	Alvey Manse	2.53
VI.	Clifton, Pembroke Road	1.81	"	Loch Ness, Drumadrochit	2.90
"	Ross, The Graig	.87	"	Glencarron Lodge	10.02
"	Shifnal, Hatton Grange	1.06	"	Fearn, Lower Pitkerrie	1.14
"	Cheadle, The Heath House	1.89	XIX.	Invershin	2.66
"	Blockley, Upton Wold	1.64	"	Altnaharra	4.40
"	Coventry, Kingswood	1.04	"	Bettyhill	2.12
VII.	Market Overton	1.20	"	Watten Station	1.54
"	Market Rasen	1.83	XX.	Dunmanway, The Rectory	3.37
"	Bawtry, Healey Hall	1.11	"	Cork	1.86
VIII.	Neston, Hinderton Lodge	1.32	"	Darrynane Abbey	4.04
"	Southport, Hesketh Park	1.70	"	Glenam [Clonmel]	2.02
"	Chatburn, Middlewood	3.49	"	Ballingarry, Gurteen	1.79
"	Cartmel, Flookburgh	2.50	"	Miltown Malbay	3.99
IX.	Langsett Moor, Up. Midhope	3.57	XXI.	Gorey, Courtown House	1.42
"	Scarborough, Scalby	1.85	"	Moynalty, Westland	2.57
"	Ingleby Greenhow	1.55	"	Athlone, Twyford	2.38
"	Mickleton	2.38	"	Mullingar, Belvedere	2.80
X.	Bardon Mill, Beltingham	1.46	XXII.	Woodlawn	2.84
"	Ewesley, Fallowlees	2.22	"	Westport, Murrisk Abbey	...
"	Ilderton, Lilburn Cottage	1.57	"	Collooney, Markree Obey	3.28
"	Kewick, York Bank	3.46	XXIII.	Enniskillen, Portora	3.07
XI.	Llanfrechfa Grange	2.58	"	Warrenpoint, Summer Hill	.78
"	Treherbert, Tyn-y-waun	4.88	"	Banbridge, Milltown	1.45
"	Carmarthen, The Friary	2.74	"	Belfast, Springfield	2.35
"	Castle Malgwyn [Llechryd]	1.76	"	Bushmills, Dundarave	2.64
"	Plynlimon	5.40	"	Stewartstown, The Square	2.95
"	Tall-y-llyn	1.60	"	Killybegs	5.66
"	New Radnor, Ednol	2.57	"	Horn Head	4.53

METEOROLOGICAL NOTES ON FEBRUARY, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—The first week was dry and frosty, but the anticyclonic conditions gave way on 7th and overcast and damp weather followed without much rise of temp. The second half of the month was milder, with considerable sunshine and, after 20th, no R. Duration of sunshine 53·7* hours and of R 23·4 hours. Mean temp. 37°·8, or 2°·0 below the average.

CROWBOROUGH.—The first 8 days were cold and thaw set in on 9th, but there was another spell of severe frost from 19th to 24th. Mean temp. 37°·5. R 1·4 in. below the average of 36 years.

HARTLEY WINTNEY.—Frost and a little fog until 10th, followed by R. The last week was bright and cold. Splendid display of aurora borealis from 9 p.m. till midnight on 9th. Terrible storm of N.E. wind on 19th and 20th. Ozone occurred every day, with a mean of 3·2.

NORTH CADBURY.—A cold and quiet month, closely parallel to those of 1901 and 1902. The R was small, making that of the three winter months far the lowest in 11 years. Vegetation was late and the pond extremely low.

CLIFTON.—The first week was fine and frosty, with N.E. winds; then warmer, with R nearly every day till 21st and S on 19th, 20th and 21st. The last week was dry, with N.W. winds. R 66 in. below the average.

BOLTON.—A normal month. The first week was cold and dull but fair and no R fell till 8th. The temp. was above the average from 8th to 19th, with R on every day but one. Fair weather again on 21st, though the last week was dull and misty. Duration of sunshine 43·7* hours, or 4·1 hours above the average. Mean temp. 39°·5, or 1°·8 above the average. An aurora of unusual brilliancy was seen on 10th.

SOUTHPORT.—Extremely sunny, the total duration being 98·2* hours, or 29·6 hours above the average. The mean temp., 37°·2, was 1°·8 below the average, the weather being very cold till 8th. R 36 in. below the average; duration 28·5 hours. Water levels were considerably lower than usual.

CARMARTHEN.—Very cold and dry, water supplies becoming low. Frost prevented fruit trees from budding too early, thus improving the prospect of fruit.

HAVERFORDWEST.—Cold and changeable, with small R. Severe gale on 19th, 20th and 21st. Fine aurora on 9th. Duration of sunshine 86·4* hours.

DOUGLAS.—Wintry with much, but not severe, frost. The first two and the fourth weeks had considerably below the average temp., but the third was wet and mild, with violent westerly gales and high seas on 19th and 20th. The R was below the average and the land where properly watered was in excellent condition.

DUMFRIES.—The early part was marked by low temp. and constant S showers. An aurora borealis of exceptional brilliancy on 9th ushered in a change to almost continuous R for 10 days. Vegetation was late and farm work in arrears.

COUPAR ANGUS.—The mean temp., 35°·8, was about the average, but the month was noteworthy for the long period of severe frost and drifting S. A welcome change to mild weather set in at the close.

BLAIR ATHOLL.—S lay on the ground for 29 days from January 24th, and continuous feeding of hill stock was necessary in the neighbourhood.

DRUMNADROCHIT.—R 05 in. below, and rain days equal to, the average of 21 years. The month was notable for gales and S and for the fine display of aurora borealis on 9th.

WATERFORD.—R 1·15 in. below the average. Mean temp. 39°·9.

DUBLIN.—A cold month, the mean temp. being 40°·3, or 2°·2 below the average. At first quiet anticyclonic weather, followed by a warm period from 13th to 19th and then a very cold spell. Overcast, quiet and anticyclonic from 22nd to the close. Stormy from 16th to 20th. Fine aurora borealis on 9th.

* Campbell-Stokes.

Climatological Table for the British Empire, September, 1906.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.	Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Inches	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
London, Camden Square	94.0	2	39.0	28	70.5	50.6	52.4	78	131.5	35.4	1.75	8	...
Malta.....	...	...	...	...	...	...	...	...	...	...	...	...	...
Lagos.....	86.0	13a	71.0	18a	83.3	73.3	72.1	79	141.0	69.0	1.67	15	8.0
Cape Town ...	74.1	21	38.3	2	63.6	48.9	47.9	73	...	...	.99	7	3.7
Durban, Natal'	80.4	15	54.4	26c	74.0	59.1	...	...	137.4	...	3.84	13	4.7
Johannesburg	79.5	16	35.0	26	70.7	48.3	46.0	68	143.8	30.0	.51	2	2.7
Mauritius.....	79.9	30	54.1	25	75.5	61.2	58.4	73	146.7	46.3	1.73	18	5.7
Calcutta.....	92.4	1, 21	75.4	12	87.7	78.6	77.9	87	157.0	74.8	6.30	13	8.5
Bombay.....	87.5	20	75.4	21	85.1	77.3	74.9	82	187.0	71.8	3.94	18	6.4
Madras	99.4	13	72.3	20	92.9	77.5	74.6	78	147.9	72.3	6.27	14	5.9
Kodaikanal	67.1	30	47.0	29	62.8	51.4	50.4	61	141.2	37.2	4.93	16	6.3
Colombo, Ceylon.....	38.4	29	74.6	29	87.1	78.5	72.8	77	150.2	73.5	.05	2	6.3
Hongkong.....	90.3	28	73.4	12	85.3	77.0	74.2	80	146.5	...	30.60	21	7.0
Melbourne.....	76.1	26	36.0	7	52.6	48.6	45.0	76	139.2	28.8	3.84	8	6.7
Adelaide	77.2	25	36.9	6	64.8	47.5	46.9	71	136.4	55.1	3.37	15	5.8
Coolgardie	79.0	28	33.2	16	67.0	43.5	39.9	57	145.4	30.0	.16	3	4.4
Sydney	70.0	6, 27	44.1	16	64.5	51.4	49.1	74	111.5	36.2	1.56	25	5.9
Wellington	61.1	16	38.5	6	55.1	42.2	41.7	74	130.0	30.0	3.04	15	6.0
Auckland	64.0	28	43.0	12	58.9	48.1	45.2	74	128.0	36.0	4.32	14	6.3
Jamaica, Negril Point..	93.9	19	70.6	29	87.8	74.0	75.0	79	...	...	4.46	9	...
Trinidad	92.0	11	68.0	20	89.1	71.3	74.0	85	161.0	68.0	6.54	20	...
Grenada.....	88.4	16	73.4	23	86.0	76.3	73.3	78	150.0	...	4.27	14	3.0
Toronto	90.4	9	41.7	25	75.2	54.5	56.7	75	116.5	36.2	...	..	2.9
Winnipeg	99.0	7	31.0	27	74.7	46.9	...	...	...	...	1.51	8	4.7
St. John's, N.B.	76.0	19	39.8	25	62.7	50.3	...	...	...	...	1.91	11	4.7
Victoria, B.C.	71.7	1	42.3	11	63.3	49.6	...	83	...	...	3.14	11	6.4
Dawson	68.0	1	15.0	28	55.0	31.7	...	...	...	...	1.14	8	5.8

a and 14. b and 21. c and 27.

Johannesburg.—First TS of the season on the 18th, absolute drought lasted 123 days.

Mauritius.—Mean temp. of air 1°·9, dew point 1°·8, below, and E .33 in. above average. Mean hourly velocity of wind 10.4 miles, or 1.6 below average.

KODAIKANAL.—Bright sunshine 184 hours.

COLOMBO.—Mean temp. of air 82°·4, or 1°·5 above, of dew point 0°·5 below, and E 5.00 in. below. averages. Mean hourly velocity of wind 9.7 miles.

HONGKONG.—Mean temp. of air 81°·0. Bright sunshine 171.2 hours, or 30 hours below average. E 22.38 in. above average. Mean hourly velocity of wind 16.7 miles, or 4.9 above average. Gales on 18th, 20th, and 29th.

Adelaide.—Mean temp. of air 0°·8 below, and E 1.66 in. above, averages. One of the wettest Septembers on record. Sunshine 19 hours below average.

Coolgardie.—Mean temp. of air 3°·1, and E .62 in. below averages of 13 years.

Sydney.—Mean temp. of air 0°·8 below, and E 1.56 in. below, averages.

Wellington.—Mean temp. of air 1°·9 below, and E 1.48 in. below, averages.

TRINIDAD.—E .89 in. below 43 years average.

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THE RAINFALL OF THE SIX WINTER MONTHS.

OCTOBER, 1906—MARCH, 1907.

THE month of March has been acclaimed in the London press as almost a miracle of fine weather. The warmth and brilliance of every morning in the latter half of the month, outside the fog zone of the metropolis, justified the quotation,

“ Oh what a dawn of day,
How the March sun feels like May ! ”

but, taken as a whole, the month was warm and dry only in the south of England and the extreme south of Ireland. Along the south coast from Kent to Cornwall there was less than half the average rainfall, and Torquay was unfortunate enough to record scarcely more than a quarter of the rain it was entitled to expect in a normal month, and on which so much of its climatic advantage depends ; but as on former occasions the serious shortage was apparently confined to a small area. In the north-west of England, and in the west of Scotland, March proved somewhat wetter than the average, and in a small area in the north of Ireland the fall was nearly twice the average, Omagh appearing to have been the centre of heaviest rain in the British Isles.

March concludes what may be termed the winter half-year, and a great deal of the comfort of the succeeding summer, especially to the dwellers in large towns, depends upon the rainfall of those months. It is obvious that when growth ceases in autumn, and while temperature is low in winter, and evaporation from the soil is practically suspended, all the water that falls upon the land is free either to run off into the rivers or to soak through the soil and replenish underground water supplies. When the leaves unfold, and grass and all vegetation are in full growth in April, and when the temperature rises and evaporation equals or exceeds the rainfall in summer, it is plain that but little of the falling rain can run the gauntlet of the eager hands on the surface stretched out to catch and absorb it, so that, save in exceptional circumstances, the winter six months alone are effectual in filling wells and reservoirs to be drawn upon in the following summer.

The winter half-year just passed is divided by the turn of the year into three wet months in 1906, and three dry months in 1907, taking the country as a whole ; but both halves of the period were wet in the west of Scotland and the north of Ireland. The figures for each month have been published in this Magazine, those for March, 1907, appearing on p. 59. The accompanying Table gives the aggregate rainfall in inches and also as percentages of the thirty years' average for the two periods of three months, and for the whole six months. It shows that the aggregate rainfall of the three months, October—December, 1906, exceeded the average in all parts of Great Britain, except round the coast from the Mersey to the Solway, and in a small area of South Devon. The excess was greater on the eastern than on the western side of the country, but it amounted to 50 per cent. only in a small area in the north Midlands. Ireland had rainfall exceeding the average only in the extreme north, and at one station in the south-west. For these three months the general rainfall of England exceeded the average by 25 per cent., that of Scotland by 15 per cent., while that of Ireland fell short of the average by 5 per cent. Looked at as a whole the general rainfall of the British Isles exceeded the average by 16 per cent.

The first three months of 1907 were remarkably dry in all parts of the country, though we believe not unprecedentedly dry in any case where a long record is available for comparison. The Table shows that in the north-west of Ireland, the west and north of Scotland, and in the east of Norfolk, the rainfall exceeded the average ; but in the south of Ireland, and in the south-west of England, from Hampshire to Devon, it was less than half the average ; this, for so long a period as three months, being a very unusual circumstance. The general rainfall of England and Wales for these three months, fell short of the average for the first quarter of the year by 33 per cent., that of Scotland by 11 per cent., and that of Ireland by 21 per cent. For the whole of the British Isles, the rainfall of the three months was 25 per cent. less than the average. The deficiency was greater than the excess of the previous three months in England and Wales, and in Scotland ; but it must be remembered that the average rainfall of the last three months of the year is considerably greater than the average rainfall of the first three months of the year, in all parts of the country, and thus the state of matters is not so serious as might appear at first sight.

Taking the winter six months into account, as a whole, the Table shows that the whole of the east of England, an area in this instance bounded by a line running from Dungeness to Liverpool, and thence to Berwick-on-Tweed, had distinctly more than the average rainfall, the excess coming to a maximum of over 25 per cent. in Norfolk and considerably exceeding 10 per cent. over the great water-gathering grounds of the Pennine chain. Wales, the Lake District, and the whole south-west of England, had in a corresponding degree a deficiency of rain, amounting to more than 25 per cent. in the east.

Rainfall, October, 1906—March, 1907.

STATION.	Oct. —Dec., 1906.	Jan. —Mar., 1907.	Oct., —Mar., 1906.	Per cent. of Average.		
	Oct. —Dec., 1906.	Jan. —Mar., 1907.	Oct., —Mar., 1906.	Oct. —Dec., 1906.	Jan. —Mar., 1907.	Oct., —Mar., 1906.
	in.	in.	in.			
London (Camden Square).....	9.56	3.05	12.61	129	59	100
Tenterden.....	12.34	3.30	15.64	129	54	100
West Dean.....	11.77	2.99	14.76	124	44	91
Hartley Wintney.....	11.16	3.16	14.32	129	51	96
Hitchin.....	10.42	3.16	13.58	142	65	111
Winslow (Addington).....	10.03	3.21	13.24	129	59	100
Bury St. Edmunds (Westley).....	10.81	3.84	14.65	149	79	121
Brundall.....	11.15	4.88	16.03	143	101	127
Winterbourne Steepleton.....	14.31	4.89	19.20	108	52	85
Torquay (Cary Green).....	9.53	3.92	13.45	85	46	68
Polapit Tamar [Launceston].....	14.44	5.85	20.29	106	64	89
Bath.....	9.78	3.19	12.97	108	49	83
Stroud (Upfield).....	10.64	3.35	13.99	124	52	93
Church Stretton (Woolstaston).....	11.31	4.75	16.06	160	67	93
Bromsgrove (Stoke Reformatory).....	8.42	2.10	10.52	124	43	90
Boston.....	9.28	3.38	12.66	142	75	115
Workshop (Hodsock Priory).....	10.26	3.60	13.86	149	74	118
Derby (Midland Railway).....	9.75	4.29	14.04	133	84	113
Bolton (Queen's Park).....	17.00	8.65	25.65	133	97	118
Wetherby (Ribston Hall).....	10.99	4.81	15.80	145	90	122
Arncliffe Vicarage.....	23.45	16.29	39.74	124	101	113
Hull (Pearson Park).....	10.63	3.78	14.41	132	69	107
Newcastle (Town Moor).....	11.81	2.86	14.67	144	51	106
Borrowdale (Seathwaite).....	41.47	28.80	70.27	99	78	89
Cardiff (Ely).....	14.27	6.28	20.55	106	64	88
Haverfordwest (High Street).....	17.87	6.11	23.98	110	52	85
Aberystwyth (Gogerddan).....	15.13	8.52	23.65	103	87	96
Llandudno.....	10.18	4.90	15.08	98	75	89
Cargen [Dumfries].....	13.17	9.32	22.49	97	83	91
Colmonell (Clachanton).....	17.92	8.50	26.42	122	75	101
Glasgow (Queen's Park).....	13.27	8.48	21.75	128	105	118
Tighnabruaich.....	22.43	15.46	37.89	123	105	115
Mull (Quinish).....	19.21	14.17	33.38	101	97	99
Dundee (Eastern Necropolis).....	9.20	3.75	12.95	112	61	90
Braemar.....	14.35	5.69	20.04	129	71	105
Aberdeen (Cranford).....	14.73	5.29	20.02	147	74	116
Cawdor (Budgate).....	11.22	5.93	17.15	140	96	121
Invergarry.....	21.26	19.52	40.78	117	119	118
Loch Torridon (Bendamph).....	32.23	30.76	62.99	112	140	124
Dunrobin Castle.....	14.32	9.27	23.59	144	124	135
Killarney (District Asylum).....	14.39	7.83	22.22	78	49	64
Waterford (Brook Lodge).....	10.55	3.75	14.30	86	38	65
Broadford (Hurdlestown).....	10.30	6.39	16.69	106	87	98
Abbey Leix (Blandafort).....	9.44	5.15	14.59	93	64	80
Dublin (Fitz William Square).....	6.69	3.66	10.35	83	61	74
Ballinasloe.....	9.31	7.53	16.84	87	89	88
Clifden (Kylesmore House).....	20.94	13.05	33.99	83	66	76
Crossmolina (Enniscoe).....	15.58	12.07	27.65	95	93	94
Seaford.....	11.61	6.45	17.96	101	70	87
Londonderry (Creggan Reservoir).....	14.89	12.82	27.71	115	137	124
Omagh (Edenfel).....	12.79	9.89	22.68	116	119	117

of South Devon, and approaching 10 per cent. over the great water-gathering grounds of Wales. It would thus appear more likely that shortage of water would occur in the course of the coming summer in the large towns supplied from Wales and the Lake District, than in those supplied from the Pennine chain, if other things were equal. As a matter of fact, however, the Welsh supplies being of more recent origin have probably a larger margin of reserve to draw upon, and unless there is an unusually hot and dry summer, shortage of water is more likely to be felt in the south and south-west of England, than in other localities.

For England and Wales as a whole the general rainfall of the six months was exactly the average; for Scotland it showed an excess of only 4 per cent., while in Ireland, where both periods had been dry, there was a deficiency of 12 per cent., the deficiency being greatest in the south, where it was more than 25 per cent., and disappearing in the extreme north, where there was on the other hand an excess of more than 20 per cent. The six months for the whole of the British Isles showed a deficiency of rainfall amounting to 2 per cent.; so that, speaking generally, the total amount of water deposited on our islands in the winter six months of 1906-07 did not differ appreciably from the average amount of the last thirty years, though there were peculiarities of distribution both in space and time. The detailed Table may for convenient reference be summarised as follows:—

General Rainfall for the Winter six months, 1906-07, as percentage of average.

	England and Wales.		Scotland.		Ireland.		British Isles.
Oct.-Dec., 1906.....	125	...	115	...	95	...	116
Jan.-Mar., 1907	67	...	89	...	79	...	75
Oct., 1906-Jan., 1907 ...	100	...	104	...	88	...	98

REMARKS ON A WATERSPOUT AND ACCOMPANYING PHENOMENA, ENCOUNTERED IN THE EUXINE.

By REGINALD PAGE.

ON the 14th July, 1906, the British steamer *Dalyarth* left the port of Novorossisk, laden with a cargo of oil-cake for the Baltic. During the spell in harbour the weather had been very hot, with a larger amount of rain than usual. On the 15th, when about 100 miles from Novorossisk on her course towards the Bosphorus, the officer of the watch observed heavy waterspouts to the northward about 8 a.m. There appeared three funnel-like spouts, separated in the columnar portions, but in the cone or upper part all uniting in a heavy mass of nimbus; the sky was mostly clear, a few low-lying cirro cumulus cloud-banks and bright, clear sunshine. The vessel, now steaming full speed, soon dropped these out of sight.

On the evening of that day the sun set behind heavy cloud-banks, and after the twilight had died away the heavens were aflame with incessant lightning. At 10 p.m. the captain was called as the vessel was abreast of Kilia Point Light—the light, however, being obscured by heavy rain clouds—and the engines were then slowed down in order that the steamer should not arrive at the Bosphorus before daylight; no vessels are allowed to enter Ottoman waters between sunset and sunrise. At midnight the scene was most impressive: sky clouded in, and over the land the lightning revealed the columns of four waterspouts, or one waterspout having four columns, each of which appeared to reach the water; the lightning was now incessant and vivid, and appeared to be confined to the vicinity of the waterspout, enabling the latter to be plainly discerned; the columns appeared to be quite black, but the spaces in between them showed up with a coppery hue; over the top an impenetrable cloud of black nimbus joined the four columns in one. The spouts were growing in magnitude and apparently moving directly towards the steamer—accordingly she was headed west and the engines were put full speed ahead in order to allow the waterspout to pass astern of the steamer,

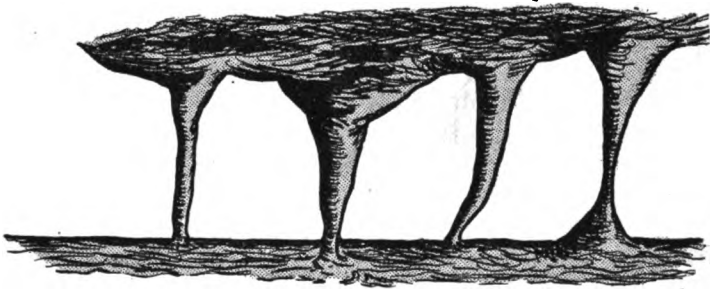


FIG 1.

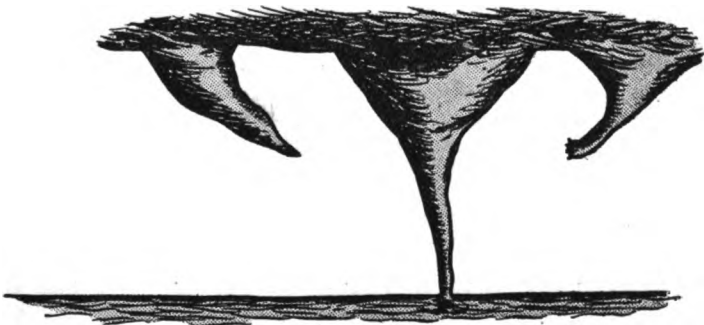


FIG 2.

About 1 a.m., as the waterspout appeared to be approaching, the course was altered to the north, thus bringing the waterspout astern; it is curious to note that though the steamer was proceeding west at her full speed the position of the waterspout in relation to the steamer remained unchanged. During this time there was no wind, yet the progress of the waterspout must have been about 15 miles per hour; as the vessel proceeded north the spout still gained, and about 2 a.m. the centre of the disturbance passed alongside and to the east of the steamer, at a distance of perhaps half-a-mile. There was a sound of broken water, resembling distant surf on a beach; a terrific deluge of rain, which obscured all view of the waterspout—even the lightning failed to penetrate through the downpouring sheets of water. The falling water was fresh.

About 3 a.m. the rain ceased and the waterspout was visible to the north-east, having now only one column reaching to the water, and two smaller columns, each of which was bending towards the rain column and no longer reaching the sea. The spout was finally lost to view amid a black mass of nimbus as day dawned. Dead fish were lying on the surface of the water, and some had even fallen on the deck of the steamer. During the passage of the waterspout the sea was considerably disturbed, the vessel rolling slightly to the swell caused by it.

SCOTTISH METEOROLOGICAL SOCIETY.

THE Half-yearly General Meeting of this Society was held on the afternoon of March 19th, at 5, St. Andrew Square, Edinburgh, Professor Crum Brown in the chair.

The following report from the Council was read:—

There has been no change in the Society's Stations since the Meeting in July.

The following Stations have been inspected since July by Mr. Watt:—Aberdeen, Balmoral, Peterhead, Glasgow (Belvedere Hospital), Leadhills, and Dumfries.

It is at this Meeting that the annual election of Office-Bearers takes place. The Members of Council who retire by rotation are Professor J. G. M'Kendrick, Sir James Marwick, and the Hon. John Abercromby. The Council recommend the re-election of the Hon. John Abercromby, and the election of Sir Archibald Buchan-Hepburn, Bart., of Smeaton, and Mr. Henry Coates, F.R.S.E., in place of the other two gentlemen.

The Registrar-General for Scotland has been regularly supplied with the Monthly and Quarterly Reports from the Office of the Society, and also, direct from the Observers in the eight large towns of Scotland, with the Daily Observations of Temperature and Rainfall required for his Weekly Reports.

The Meteorological Office in London has received direct from the Observers at Lairg, Glencarron, Balmoral, Fort Augustus, Fort William, Clathick, Marchmont, Dumfries, and Cally, Daily Observations of Tem-

perature, Rainfall, and, in some cases, Sunshine, for their Weekly Weather Reports.

Meteorological Statistics have been sent as usual to several Medical Officers of Health in various parts of Scotland for their Annual Reports.

The Council have appointed Mr. Andrew Watt, M.A., F.R.S.E., Assistant Meteorological Secretary. The Council have also agreed that Mr. Watt should occasionally deliver Lectures, under the auspices of the Society, on subjects of popular interest connected with Meteorology.

The Council have much pleasure in announcing the receipt of a donation of £100 from the Hon. John Abercromby.

Dr. Buchan's time has been very largely devoted to the carrying on of the general discussion of the Ben Nevis records. In connection with this discussion he has investigated the occurrence of Thunder and Lightning in Scotland, and a Paper on this subject will be communicated to the Meeting to-day.

Dr. Buchan communicated a paper on "Thunderstorms in Scotland," in the preparation of which he had been assisted by Mr. Herbert Bell, M.A., B.Sc. The weather journals of the keepers of the Scottish lighthouses had been analysed for the 21-year period, 1884-1904, and the annual and diurnal periods of thunderstorms, of thunder alone, and of lightning as an independent phenomenon, were discussed. It was pointed out that whilst thunderstorms had a maximum frequency about 5 p.m., thunder alone appeared to have a maximum earlier by some two hours; the morning hours of minimum frequency differed in the same way. In the case of the Ben Nevis records there was a similar difference of phase, but lightning alone, as observed from the high-level station, had a very distinct midnight maximum, as was the case over the ocean, whilst at lower levels the greatest frequency was some hours earlier. As had already been shown in the case of rainfall, there was a well-marked 11-year period in the occurrence of thunderstorms in Scotland; at least, that was the case for the time under discussion, during which thunderstorms were unusually frequent about 1884 and 1895. It was of great interest to note that this periodicity was in entire agreement with that shown by Steen to exist for Scandinavia and Denmark, the sympathy with Denmark being extremely close.

A paper by Mr. R. T. Omond on "Variations in Mean Monthly Temperatures at Edinburgh," was based on the statistics of R. C. Mossman's memoir on the climate of Edinburgh, and dealt with the 100-year period, 1801-1900.

(1). Comparing the average temperature of each month with the 100-year normal for the month, it was at once apparent that the range of difference was much greater in winter than in summer. Thus, for January and July we had:—

	JANUARY.		JULY.
Normal	37·1	.....	58°·5
Highest	44·6 in 1898	.....	64·0 in 1852
Lowest	26·5 „ 1814	.....	54·4 „ 1879
Range	18·1	.....	9·6

(2). Considering the average departures from the normal, a similar contrast was found between summer and winter. Thus, the average departure for the three winter months was $2^{\circ}5$, whilst for the summer period, June—August, it was hardly $1^{\circ}5$. The causes of these contrasts between the extreme seasons were discussed.

(3). The most frequently occurring temperature for each month was considered, and it was found that the "Scheitelwerth," or Median Value, was in winter about 2° above the normal, and in summer about 1° below. In spring and autumn there was a fair agreement between the normal and the most frequent value, and these results were in accordance with what had been found for some other places in Europe. In winter a large number of cases with a + departure were balanced by a smaller number of cases with a large — departure, and the opposite held good in summer. The explanation was pointed out: Our skies might be said to be normally cloudy, but when a period of comparatively clear sky did occur, then in winter terrestrial radiation was active at night with low temperatures. In summer, on the other hand, during a clear period, solar radiation was very effective, and the air had not time to cool down much during the short night. In spring and autumn, however, a clear sky both raised the day temperature and lowered that of the night, leaving the monthly mean but little affected.

Discussion followed the reading of both papers, and the authors were thanked for their contributions.

ROYAL METEOROLOGICAL SOCIETY.

THE March meeting of this Society is always the popular night of the session, and Wednesday evening, the 20th ult., was no exception to the rule. The large hall of the Institution of Civil Engineers was crowded with Fellows and their friends, who had gathered together to hear Major B. Baden-Powell deliver a lecture on "The Exploration of the Air."

The President, Dr. H. R. Mill, said that during the last few years special attention had been directed to the study of the free atmosphere at heights far above the ground. Previously the study of meteorology was scarcely concerned with anything but the phenomena at the Earth's surface, and meteorologists only felt competent to deal with those layers of the air immediately around them. They were now beginning to rise in the air, if not in the world, and were looking eagerly at regions of the atmosphere which formerly lay entirely beyond their reach. Efforts had been made by the Royal Meteorological Society to encourage the renewal of research by means of kites and balloons, and Mr. Dines, who had done so much in this way, had on more than one occasion described his work to them. That evening they were to have the pleasure of having a lecture from one of the pioneers in the use of kites, and some of

the lantern slides which the lecturer would show, would be something of a revelation to most of them.

Major B. F. S. Baden-Powell began his lecture by saying that the atmosphere forms a vast ocean above us—an ocean but little explored. We crawl about the ground like crabs on the bottom of the sea. We make our meteorological observations down on the ground, ignorant of all that is going on in the midst of that great expanse of air above our heads where the clouds hang about; where the rain and the hail are formed; where the lightning flashes have their origin. We look to the cross of St. Paul's, or the top of the Eiffel Tower, as the most exalted of points at which to observe the mechanism of the atmosphere; yet these compare to the aerial ocean but as a pin stuck in the carpet does to the air of a room. If all the clouds in the sky were suddenly solidified in their various shapes and different elevations, what vast realms of unexplored territory there would be. But even though not solid land, there is still plenty to explore in these regions of ever-changing cloudland. If we can mount up among them, we can ascertain the temperature, the humidity, the air pressures, the electrical effects, and many other points on which we are at present very ignorant.

Major Baden-Powell stated that there are two classes of people interested in the exploration of the atmosphere: (1) The meteorologists, who study it chiefly to find out about the weather; and (2) the inventors, who would utilise it as a highway of travel. But these two are by no means rivals. The attainment of their objects will be of mutual assistance to one another. The aerial navigator will want to know all about the currents and the conditions of the air, while the meteorologist will derive the utmost benefit from the ability to visit any parts of the atmosphere. There are three means now at the service of man by which he may ascend into these desirable regions, or may send up self-recording instruments to probe the mysteries of the skies—viz., balloons, kites and flying machines. Although at the time of its invention the balloon was hailed with acclamation as promising the conquest of the air to man, yet it is now realised that this cumbrous and delicate apparatus is not capable of much practical application. It is, nevertheless, useful (1) as an observatory for scientific investigation; (2) as a means of reconnaissance in war; and (3) as a most agreeable way of spending an hour or two in blissful peace and sublimity. But recently great strides have been made in the improvement of the balloon in the way of providing it with engines and propellers, so that it may be driven to any predetermined goal. Twenty-five years ago the French Government made the first dirigible airship, and now they possess one, if not more, that seems to be a really practical air vessel of war. Count Zeppelin, in Germany, has also produced a machine which in point of size, as well as in speed, has beaten all records. Going to the other extreme, we have small balloons now capable of attaining the greatest heights, carrying self-recording instruments.

Such contrivances have recently ascended to the enormous altitude of 82,000 feet, or nearly 16 miles above the surface of the Earth. Closely connected with this subject of *ballons sondes*, as the French call them, is that of meteorological kites. These also have been much improved in recent years, and instruments lifted by kites retained by steel wires have actually ascended to a height of four miles. Kites of a much larger dimension have also come into use during the last few years. At Aldershot they have been regularly introduced into the service. Men were first lifted by this means in 1895, in which year the lecturer made a number of ascents up to 100 feet high, but improvements have gradually followed until now men have actually gone up to a height of 3000 feet, an elevation practically beyond the reach of rifle bullets, and so high as to render the aeronaut almost invisible.

Major Baden-Powell, in conclusion, referred to a subject which, if it had not hitherto had any very practical results, yet promises to bring about perhaps the most extraordinary changes in the life of man that have resulted from any of the marvellous inventions of the 19th or 20th centuries. The flying machine has come, and it has come to stay. Years ago people argued that it was impossible to lift in the air that which was far heavier than the air. But the advocates of the cause pointed to the birds, and there was no gain-saying that the thing was possible. Then the pessimists cried that it would not be possible to balance the apparatus without the intelligence of the bird, but models were made, finally so good as to fly for three-quarters of a mile. Then men took to gliding on wings and sailing on the wind. Huge machines were constructed with very light engines, and finally, during the last two or three years, not only have men been successfully raised off the ground, but have been able to sustain themselves in the air for half-an-hour at a time. Very little more now remains to be done before we can say that man has veritably conquered the air.

The lecture was illustrated by lantern slides and models.

The following gentlemen were elected Fellows of the Society:—Major B. F. S. Baden-Powell, Señor D. Bebianno, Mr. R. T. G. Cross, Mr. B. J. Donnellan, Mr. G. A. Green, Mr. H. W. Hipwell, Major J. Bruce Kingsmill, Mr. E. L. Mansergh, M.Inst.C.E., Mr. W. L. Mansergh, Assoc. M.Inst.C.E., and Pandit G. M. Vidyabhusan.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

SUNSHINE RECORDERS.

I HAVE read with much interest Mr. Edward Kitto's remarks on sunshine recorders on page 13 of the February Magazine.

With reference to the "objection to the Jordan recorder" alluded to, perhaps I may be allowed a word of explanation, as it seems to

me that any "want of uniformity in the sensitiveness of the paper employed" is not so important a matter as would at first appear, seeing that the only purpose of the instrument is to record the duration of bright sunshine, and not the varying intensity of the sun's rays. In the latter case, a perfect uniformity of sensitiveness would necessarily be all-important.

However sensitive the paper may be, the construction of the instrument precludes the possibility of its registering too much sunshine, for, unless the sun's rays are bright enough to cast a distinct image of the aperture through which they shine on the surface of the sensitized chart, there will be no impression or trace produced. On the other hand, if the photographic chart is sufficiently sensitive to register the image, however faint it is, a trace of the bright sunshine will be secured, and the purpose of the instrument would seem to be attained.

An excess of the sensitiveness will merely exhibit a more deeply coloured trace, without in any way augmenting its apparent duration.

JAMES B. JORDAN.

"Hayfield," Hythe, Kent, March 5th, 1907.

RAPID FORMATION OF FOG AND GLOOM.

DURING the afternoon of February 28th, at 2.45 p.m., I was coming across Epsom Downs; it had been, and was then, a brilliantly fine and warm day, with continuous sunshine and a cloudless blue sky. An exceptional degree of visibility also prevailed—the tower on the top of Leith Hill standing out with marked clearness. At 3 p.m., when I reached the highest ridge of the Downs (about 470 feet), which commands a view in all directions, there was no apparent change in the conditions, save for a well-defined fog-bank which appeared to extend from N. to N.E., and upwards towards the zenith. A few seconds' observation showed that this bank was approaching very rapidly, and extending laterally. It reached the zenith at 3.2 p.m., and by 3.5 p.m. the landscape had been entirely blotted out, objects 10 feet distant being quite invisible; the bright sunshine had given place to a sun of a vivid crimson hue. Very well-marked fog-billows were visible; they moved with a wave-like motion from N.E. to S.W., at a height of about six feet, light grey in colour and very damp. They were accompanied by a current of cold air. Overhead there was a thick gloom of a brownish hue. A very appreciable cooling of the atmosphere took place, with a great accession of moisture. The wind at 3 p.m. was S.E.; force 1, veering at 3–5 p.m. through E. to E.N.E., force 2. The retreat of the phenomenon was very nearly as rapid as its approach; dense fog and gloom prevailed at 3.40 p.m., and at 3.45 p.m. this had given place to practically the same conditions as at 3 p.m. The outline of the fog-bank was again visible in a S. to S.W. direction.

The phenomenon appears to have been confined only to the high ground, as at this station (160 feet) nothing more than the passage of a high fog was noticed at 3 p.m. ; this was of short duration, and was accompanied by a temporary and very slight obscuration of sunshine. The thermograph trace shows a rapid drop in temperature of 8° in a few minutes at 3 p.m., 53° to 45°, and a recovery to 48° at 3.15 p.m.

SPENCER C. RUSSELL, F.R.Met.Soc.

Epsom, March 2nd, 1907.

PROTRACTED DROUGHT IN MID-WESSEX.

MARCH, 1907, has been in these parts the driest of four consecutive dry months.

I gather from about thirty returns of rainfall over the region which lies between Shaftesbury and Langport, E. and W., and Shepton Mallet and Beaminster, N. and S., that the rainfall for the first quarter of 1907 is only about 40 per cent. of the average. At many of our stations the whole fall of the three months is less than half of the fall in January, 1906. Not one of the stations reports any other year so dry in its first quarter, and those years, viz, 1898 and 1902, which came nearest to this, though *longo intervallo*, were preceded by *very* wet Decembers ; whereas last December was the driest but one for probably 14 years.

At North Cadbury the four months just ended gave a total of 4.40 in., as against an average of 11.11 in. for the same months in the previous ten winters, and a previous lowest, viz., in 1904-5, of 8.56 in.

The warmth of the days, and the sunniness of March, were quite unusual ; and on comparing my figures now taken here with those recorded by me at Patras, on the shore of the west coast of Greece, in lat. 38° N., in March, 1874, I find a result so extraordinary that it should be put on record :—

	NORTH CADBURY.		PATRAS, GREECE.	
	March, 1907.		March, 1874.	1873.
Highest Maximum in Shade ...	71.0	.....	61.1	82.0
Average " " " ...	55.9	.....	52.8	65.7
Lowest " " " ...	45.0	.....	40.0	60.2

That March in Greece was truly of unprecedented severity, but it, too, was fairly dry and sunny, and I should not have expected the warmest March in England so far to have surpassed it in day warmth.

March, 1873, at Patras was as unusually hot, so I add the figures for that year also (vide *Quarterly Journal* of the Royal Meteorological Society for July, 1875, and July, 1877).

H. A. BOYS, F.R.Met.S.

North Cadbury Rectory, April 4th, 1907.

JAPANESE METEOROLOGICAL OBSERVATIONS IN CHINA AND KOREA.

By L. C. W. BONACINA.

DURING 1904 and 1905 an extensive system of meteorological observations in China and Korea was established by the Japanese Government, and the results have appeared in a number of pamphlets published by the Central Meteorological Observatory at Tokio.

The contents of these pamphlets, which include an English translation of the Japanese text, consist of masses of tables relating to the various meteorological elements upon which the observations were made at ten stations in China, five in Korea, and one in Yezo. The instruments and method of observation accord with those in use at all meteorological stations in Japan, and the time adopted is the Central Standard, or the mean time of the meridian of 135° E. The barometric and vapour-tension readings as well as the rainfall measurements are given in millimetres, the velocities of the wind are expressed in metres per second, and the degrees of temperature are on the Centigrade scale. The record for 1904 is very fragmentary, but that for 1905 is much better, and is complete for nine out of the sixteen stations.

The Table which follows gives a few interesting figures as obtained from the nine complete records in 1905. It will be noticed that the range of temperature between the absolute extremes for the year was in every case very large, which accords well with what we already know concerning the severity of the seasons in China. That a temperature of $21^{\circ}9$ F. should have occurred at Hangchow in latitude 30° N. and on the Pacific sea-board, certainly calls for remark. At Fusan, in Korea, the extremes were of the same order that occurs in the inland parts of England during an average year, viz., 90° F. and 15° F. The number of thunderstorm days at the several places was on the whole considerably greater than is usually experienced in England, but the number of snowy days, or days with snow, was about the same as occurs scattered through the late autumn, winter and spring in an average year at places in the lower-lying parts of England, viz., from ten to thirty. The high rainfall at Hangchow and Nankin should be noted, for, as these places are situated in the plain of Western China, it is probably associated with the low latitude of the places and their proximity to the Pacific.

It is sincerely to be hoped that the system of observations here discussed will prove to be the commencement of a long and valuable series which will enable a comparison to be instituted between the variability of the seasons from year to year in Eastern Asia with the variability in Western Europe, where it is so very pronounced a feature of the climate.

Summary of Meteorological Observations in Korea and China, 1905.

STATION.	Latitude N.	Longitude E.	Temperature, F. abs. max. ; abs. min.	Total Rainfall in inches.	No. of days with Thunder- storms.	No. of days with Snow.
In KOREA :—						
Chemulpo	37 29	126 37	90·7 ; 8·4	54·72	16	21
Yongampo.....	39 56	124 22	88·0 ; 1·4	45·68	12	13
Wonsan.....	39 9	127 26	94·8 ; 2·1	73·33	7	27
Fusan.....	35 6	129 3	89·8 ; 15·0	80·60	19	5
In CHINA :—						
Nanking.....	32 5	118 49	100·4 ; 21·2	49·77	27	16
Hangchow.....	30 11	120 12	103·3 ; 21·9	75·64	37	18
Yinkow.....	40 40	122 14	90·9 ; -5·8	24·88	17	17
Tiensin.....	39 10	117 10	104·7 ; 9·3	19·74	25	6
Tairen.....	38 56	121 36	90·0 ; 3·0	21·55	18	15

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## REVIEWS.

*Climatology of the United States.* By ALFRED JUDSON HENRY, Professor of Meteorology. Prepared under direction of WILLIS L. MOORE, Chief U.S. Weather Bureau. Washington, 1906. Size  $11\frac{1}{2} \times 9\frac{1}{2}$ . Pp. 1012. Price \$10.

THIS massive volume deals with the climatology of the United States, on the basis of observations mainly made between 1870 and 1903, including the whole period of activity of the national meteorological organization under the Signal Service and the Weather Bureau up to date.

The first chapter deals with the broad features of the climate of the United States in 112 pages, supplemented by a large number of maps illustrating normal and extreme distributions of the climatic elements, and also various typical instances of weather. Then follows a section on the climatology of each of the following regions: New England and Middle Atlantic States, South Atlantic and East Gulf States, the West Gulf and southern Rocky Mountain slope, the North Central States, the Rocky Mountain and Plateau region, and the Pacific slope. After a brief introduction, the stations in each state are dealt with consecutively, a page being devoted to each containing the means and extremes of monthly, seasonal and annual temperature and precipitation for the period during which the observations extended. In some cases humidity, wind-direction and sunshine are added. The actual figures for individual months and years are not given, and so far as we have read we have not observed any attempt to show the relation of the means of short periods to long averages or normal values.

*Die tägliche Gang der Temperatur in der äusseren Tropenzone.*  
*A. Das Amerikanische und Afrikanische Tropengebiet.* [The daily  
 march of temperature in the outer tropical zones. A. The  
 American and African tropical districts.] Von JULIUS HANN.  
 Wein, 1907. Size  $12\frac{1}{2} \times 9\frac{1}{2}$ . Pp. 88.

DR. HANN had previously dealt with the conditions of daily temperature in the equatorial part of the tropical zone—to  $15^{\circ}$  N. and S.—and he here extends the “laborious and thankless labour” of compiling the scattered and unequal data for the outer portions of the zone as far as the northern and southern tropics. The collection of all available data which is contained in this memoir must prove of the utmost utility to the student of the wider problems of world meteorology, all the tables being arranged on the same plan and reduced in every instance to the centigrade scale.

*Grundzüge einer Theorie der synoptischen Luftdruckveränderungen* [Basis of a theory of synoptical pressure changes]. Von DR. FELIX M. EXNER. Wien, 1906. Size  $10 \times 6\frac{1}{2}$ . Pp. 76.

A MATHEMATICAL discussion of the movements of isobaric forms, based largely upon the work of the U.S. Weather Bureau.

### METEOROLOGICAL NEWS AND NOTES.

DR. SHAW'S COURSE OF LECTURES on Dynamical Meteorology at University College, Gower Street, will be resumed on Monday, 29th April, at 5 p.m., and continued on Fridays and Mondays until May 17th, when the last lecture of the course will be delivered.

“BALLOONING AND AERONAUTICS” is the title of a new illustrated monthly magazine, published at one shilling net, by Messrs. Guide and Co. It deals in a comprehensive and interesting way with matters which are so far on the borders of meteorology that all experiments to improve aeronautics at present involve knowledge of weather conditions, while in the future perfected methods of movement through the air may be expected to promote the scientific study of the conditions of the upper atmosphere.

**CORRECTIONS.**—In Mr. Clark's paper on “A relation between Rain-fall at York and Solar Cycles,” on p. 32 of last month's issue, the last two lines of the third paragraph and the first line of the fourth paragraph should read as follows:—

September were 30·53 in. and 45·19 in; for October 35·62 in. and 49·61 in.  
 Again, for August and October the contrast is true of *each* cycle.

In Mr. Gaw's article on “Atmospheric phenomena during the Chile Earthquake,” in the January number (Vol. 41, p. 226), the word “minutes” in the seventh line from the bottom of p. 227 should be “seconds,” and the line should read:—

8 h. 7 m. 30 s. with 20 seconds' duration. The latter shook was the

## TEMPERATURE FOR MARCH, 1907.

| STATION.                             | COUNTY                | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |        |      |       | No. of Nights<br>ator below 32° |        |
|--------------------------------------|-----------------------|------------|----------------------|--------------------------------|--------------|--------|------|-------|---------------------------------|--------|
|                                      |                       |            |                      |                                | Max.         |        | Min. |       | Shade.                          | Grass. |
|                                      |                       |            |                      |                                | °            | Date.  | °    | Date. |                                 |        |
| Camden Square.....                   | London .....          | 51 32      | 0 8                  | 111                            | 68·7         | 31     | 24·4 | 12    | 9                               | 20     |
| Tenterden .....                      | Kent .....            | 51 4       | 0 41                 | 190                            | 69·4         | 31     | 25·0 | 12    | 9                               | 24     |
| West Dean .....                      | Hampshire .....       | 51 3       | 1 38                 | 137                            | 66·0         | 28†    | 19·0 | 12    | 19                              | 22     |
| Hartley Wintney .....                | .....                 | 51 18      | 0 53                 | 222                            | 69·0         | 30     | 21·0 | 12    | 19                              | 23     |
| Hitchin .....                        | Hertfordshire .....   | 51 57      | 0 17                 | 238                            | 70·0         | 31     | 22·0 | 12    | 13                              | ...    |
| Winslow (Addington) .....            | Buckinghamsh. ....    | 51 58      | 0 53                 | 309                            | 69·0         | 30, 31 | 22·0 | 12    | 16                              | 22     |
| Bury St. Edmunds (Westley) .....     | Suffolk .....         | 52 15      | 0 40                 | 226                            | 70·0         | 31     | 25·0 | 5     | 16                              | ...    |
| Brundall .....                       | Norfolk .....         | 52 37      | * 1 26               | 66                             | 70·0         | 30     | 26·8 | 5     | 9                               | 22     |
| Winterbourne Steepleton .....        | Dorset .....          | 50 42      | 2 31                 | 316                            | 62·8         | 31     | 20·0 | 12    | 18                              | 19     |
| Torquay (Cary Green) .....           | Devon .....           | 50 28      | 3 32                 | 12                             | 59·0         | 30     | 30·0 | 12    | 2                               | 17     |
| Polapit Tamar [Launceston] .....     | .....                 | 50 40      | 4 22                 | 315                            | 64·6         | 28     | 24·7 | 5     | 13                              | 19     |
| Bath .....                           | Somerset .....        | 51 23      | 2 21                 | 67                             | 67·0         | 28     | 24·8 | 5     | 16                              | ...    |
| Stroud (Upfield) .....               | Gloucestershire ..... | 51 44      | 2 13                 | 226                            | 63·0         | 30, 31 | 28·0 | 11    | ...                             | ...    |
| Church Stretton (Woolstaston) .....  | Shropshire .....      | 52 35      | 2 48                 | 800                            | 64·5         | 28, 30 | 18·5 | 4     | 22                              | ...    |
| Bromsgrove (Stoke Reformatory) ..... | Worcestershire .....  | 52 19      | 2 4                  | 225                            | 65·0         | 27, 31 | 20·0 | 11    | 19                              | ...    |
| Boston .....                         | Lincolnshire .....    | 52 58      | 0 1                  | 25                             | 68·0         | 30     | 25·0 | 12    | 11                              | ...    |
| Worksop (Hodsock Priory) .....       | Nottinghamshire ..... | 53 22      | 1 5                  | 56                             | 68·3         | 31     | 24·4 | 12    | 15                              | 24     |
| Derby (Midland Railway) .....        | Derbyshire .....      | 52 55      | 1 28                 | 156                            | 69·0         | 31     | 24·0 | 11    | 16                              | ...    |
| Bolton (Queen's Park) .....          | Lancashire .....      | 53 35      | 2 28                 | 390                            | 66·3         | 31     | 28·5 | 24    | 5                               | 18     |
| Wetherby (Ribston Hall) .....        | Yorkshire, W.R. ....  | 53 59      | 1 24                 | 130                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Arncliffe Vicarage .....             | .....                 | 54 8       | 2 6                  | 732                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Hull (Pearson Park) .....            | ..... E.R. ....       | 53 45      | 0 20                 | 6                              | 69·0         | 30     | 28·0 | 12    | 10                              | 20     |
| Newcastle (Town Moor) .....          | Northumberland .....  | 54 59      | 1 38                 | 201                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Borrowdale (Seathwaite) .....        | Cumberland .....      | 54 30      | 3 10                 | 423                            | 63·3         | 26     | 28·1 | 12    | 7                               | ...    |
| Cardiff (Ely) .....                  | Glamorgan .....       | 51 29      | 3 13                 | 53                             | ...          | ...    | ...  | ...   | ...                             | ...    |
| Haverfordwest (High Street) .....    | Pembroke .....        | 51 48      | 4 58                 | 95                             | 62·1         | 26     | 27·2 | 24    | 6                               | 16     |
| Aberystwyth (Gogerddan) .....        | Cardigan .....        | 52 26      | 4 1                  | 83                             | 70·0         | 31     | 23·0 | 5     | ...                             | ...    |
| Llandudno .....                      | Carnarvon .....       | 53 20      | 3 50                 | 72                             | 66·5         | 29     | 32·5 | 12    | ...                             | ...    |
| Cargen [Dumfries] .....              | Kirkcudbright .....   | 55 2       | 3 37                 | 80                             | 62·0         | 29     | 25·0 | 12    | 8                               | ...    |
| Lilliesleaf (Riddell House) .....    | Roeburgh .....        | 55 31      | 2 46                 | 550                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Edinburgh (Royal Observatory) .....  | Midlothian .....      | 55 55      | 3 11                 | 442                            | 64·0         | 29     | 27·7 | 10    | 5                               | 10     |
| Colmonell (Clachanton) .....         | Ayr .....             | 55 8       | 4 54                 | 140                            | 61·0         | 29     | 23·0 | 13    | ...                             | ...    |
| Glasgow (Queen's Park) .....         | Renfrew .....         | 55 53      | 4 18                 | 144                            | 63·0         | 29     | 28·0 | 8, 9  | 7                               | 19     |
| Tighnabruaich .....                  | Argyll .....          | 55 55      | 5 14                 | 50                             | 50·0         | 27†    | 26·0 | 8     | 13                              | 13     |
| Mull (Quinish) .....                 | .....                 | 56 36      | 6 13                 | 35                             | 64·0         | 31     | ...  | ...   | ...                             | ...    |
| Dundee (Eastern Necropolis) .....    | Forfar .....          | 56 28      | 2 57                 | 199                            | 61·2         | 27, 28 | 23·4 | 12    | 9                               | ...    |
| Braemar .....                        | Aberdeen .....        | 57 0       | 3 24                 | 1114                           | ...          | ...    | ...  | ...   | ...                             | ...    |
| Aberdeen (Cranford) .....            | .....                 | 57 8       | 2 7                  | 120                            | 64·0         | 27     | 16·0 | 11    | 13                              | ...    |
| Cawdor (Budgate) .....               | Nairn .....           | 57 31      | 3 57                 | 250                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Invergarry .....                     | E. Inverness .....    | 57 4       | 4 47                 | 130?                           | ...          | ...    | ...  | ...   | ...                             | ...    |
| Loch Torridon (Bendamph) .....       | W. Ross .....         | 57 32      | 5 32                 | 20                             | ...          | ...    | ...  | ...   | ...                             | ...    |
| Dunrobin Castle .....                | Sutherland .....      | 57 59      | 3 56                 | 14                             | 59·0         | 27     | 25·0 | 12    | 9                               | ...    |
| Castletown .....                     | Caithness .....       | 58 35      | 3 23                 | 100                            | 61·0         | 27, 29 | 18·0 | 11    | 15                              | 16     |
| Killarney (District Asylum) .....    | Kerry .....           | 52 4       | 9 31                 | 178                            | 64·5         | 28     | 38·0 | 22    | ...                             | ...    |
| Waterford (Brook Lodge) .....        | Waterford .....       | 52 15      | 7 7                  | 104                            | 59·0         | 27     | 28·0 | 23    | 3                               | ...    |
| Broadford (Hurdlestown) .....        | Clare .....           | 52 48      | 8 38                 | 167                            | 56·0         | 27, 29 | 28·0 | 6     | 3                               | ...    |
| Abbey Leix (Blandsfort) .....        | Queen's County .....  | 52 56      | 7 17                 | 532                            | 60·0         | 27     | 29·0 | 1, 23 | ...                             | 10     |
| Dublin (Fitz William Square) .....   | Dublin .....          | 53 21      | 6 14                 | 54                             | 64·1         | 27     | 31·8 | 31    | 1                               | 9      |
| Ballinasloe .....                    | Galway .....          | 53 20      | 8 15                 | 160                            | 67·5         | 27, 28 | 22·0 | 23    | 12                              | ...    |
| Clifden (Kylemore House) .....       | .....                 | 53 32      | 9 52                 | 105                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Crossmolina (Ennisiscoe) .....       | Mayo .....            | 54 4       | 9 18                 | 74                             | ...          | ...    | ...  | ...   | ...                             | ...    |
| Seaforde .....                       | Down .....            | 54 19      | 5 50                 | 180                            | 57·0         | 25     | 30·0 | 5     | 5                               | 18     |
| Londonderry (Creggan Res.) .....     | Londonderry .....     | 54 59      | 7 19                 | 320                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Omagh (Edenfel) .....                | Tyrone .....          | 54 36      | 7 18                 | 280                            | 59·0         | 27     | 28·0 | 22    | ...                             | ...    |

† and 30, 31.

† and 29, 31.

## RAINFALL FOR MARCH, 1907.

| RAINFALL OF MONTH. |       |                    |            |                    |             |     | RAINFALL FROM JAN. 1. |        |                      |            | Mean Annual 1870-1899. | STATION.            |
|--------------------|-------|--------------------|------------|--------------------|-------------|-----|-----------------------|--------|----------------------|------------|------------------------|---------------------|
| ver. 0-99.         | 1907. | Diff. from Av. in. | o/o of Av. | Max. in. 24 hours. | No. of Days |     | Aver. 1870-99.        | 1907.  | Diff. from Aver. in. | o/o of Av. |                        |                     |
| in.                | in.   | in.                |            | in.                | Date.       |     | in.                   | in.    | in.                  | in.        | in.                    |                     |
| '62                | '97   | - '65              | 60         | '23                | 12          | 13  | 5'13                  | 3'05   | - 2'08               | 59         | 25'16                  | Camden Square       |
| '89                | '88   | -1'01              | 47         | '14                | 5           | 12  | 6'10                  | 3'30   | - 2'80               | 54         | 28'36                  | Tenterden           |
| '79                | '54   | -1'25              | 30         | '19                | 16          | 10  | 6'74                  | 2'99   | - 3'75               | 44         | 29'93                  | West Dean           |
| '77                | 1'00  | - '77              | 56         | '19                | 16          | 12  | 6'22                  | 3'16   | - 3'06               | 51         | 27'10                  | Hartley Wintney     |
| '53                | '97   | - '66              | 63         | '21                | 13          | 12  | 4'88                  | 3'16   | - 1'72               | 65         | 24'66                  | Hitchin             |
| '62                | 1'14  | - '48              | 70         | '19                | 12          | 13  | 5'40                  | 3'21   | - 2'19               | 59         | 26'75                  | Addington           |
| '64                | 1'02  | - '62              | 62         | '31                | 19          | 9   | 4'89                  | 3'84   | - 1'05               | 79         | 25'39                  | Westley             |
| '65                | 1'39  | - '26              | 84         | '35                | 9           | 14  | 4'81                  | 4'88   | + '07                | 101        | 25'40                  | Brundall            |
| 2'41               | 1'01  | -1'40              | 42         | '28                | 16          | 12  | 9'42                  | 4'89   | - 4'53               | 52         | 39'00                  | Winterbourne Stpltn |
| 2'45               | '66   | -1'79              | 27         | '33                | 16          | 7   | 8'51                  | 3'92   | - 4'59               | 46         | 35'00                  | Torquay             |
| 2'41               | 1'41  | -1'00              | 58         | '46                | 16          | 15  | 9'12                  | 5'85   | - 3'27               | 64         | 38'85                  | Polapit Tamar       |
| 1'94               | '70   | -1'24              | 36         | '17                | 16          | 12  | 6'58                  | 3'19   | - 3'39               | 49         | 30'75                  | Bath                |
| 1'86               | '69   | -1'17              | 37         | '12                | 16          | 13  | 6'45                  | 3'35   | - 3'10               | 52         | 29'85                  | Stroud              |
| 2'01               | 1'34  | - '67              | 67         | '21                | 19          | 15  | 7'09                  | 4'75   | - 2'34               | 67         | 33'04                  | Woolstaston         |
| 1'36               | '63   | - '73              | 46         | '15                | 9           | 9   | 4'90                  | 2'10   | - 2'80               | 43         | 24'50                  | Bromsgrove          |
| 1'36               | 1'46  | + '10              | 107        | '45                | 19          | 10  | 4'50                  | 3'38   | - 1'12               | 75         | 23'30                  | Boston              |
| 1'55               | 1'38  | - '17              | 89         | '55                | 19          | 16  | 4'87                  | 3'60   | - 1'27               | 74         | 24'70                  | Hodsock Priory      |
| 1'49               | 1'38  | - '11              | 93         | '51                | 19          | 13  | 5'10                  | 4'29   | - '81                | 84         | 26'18                  | Derby               |
| 2'88               | 3'87  | + '99              | 134        | '99                | 9           | 16  | 8'93                  | 8'65   | - '28                | 97         | 42'43                  | Bolton              |
| 1'85               | 1'71  | - '14              | 92         | '44                | 19          | 11  | 5'37                  | 4'81   | - '56                | 90         | 26'96                  | Ribston Hall        |
| 5'03               | 7'25  | +2'22              | 144        | 1'53               | 16          | 16  | 16'10                 | 16'29  | + '19                | 101        | 60'96                  | Arncliffe Vic.      |
| 1'79               | 1'23  | - '56              | 69         | '34                | 19          | 14  | 5'45                  | 3'78   | - 1'67               | 69         | 27'02                  | Hull                |
| 2'10               | 1'13  | - '97              | 54         | '41                | 9           | 13  | 5'64                  | 2'86   | - 2'78               | 51         | 27'99                  | Newcastle           |
| 0'51               | 14'10 | +3'59              | 134        | 4'25               | 16          | 17  | 36'86                 | 28'80  | - 8'06               | 78         | 132'68                 | Seathwaite          |
| 2'79               | 1'71  | -1'08              | 61         | '50                | 15          | 13  | 9'77                  | 6'28   | - 3'49               | 64         | 42'81                  | Cardiff             |
| 3'03               | 1'53  | -1'50              | 50         | '35                | 16          | 14  | 11'86                 | 6'11   | - 5'75               | 52         | 47'88                  | Haverfordwest       |
| 2'93               | 2'56  | - '37              | 87         | '55                | 6           | 16  | 9'83                  | 8'52   | - 1'31               | 87         | 45'41                  | Gogerddan           |
| 1'97               | 1'93  | - '04              | 98         | '55                | 9           | 13  | 6'51                  | 4'90   | - 1'61               | 75         | 30'98                  | Llandudno           |
| 3'01               | 4'33  | +1'32              | 144        | 1'22               | 16          | 13  | 11'17                 | 9'32   | - 1'85               | 83         | 43'43                  | Cargen              |
| 2'40               | ...   | ...                | ...        | ...                | ...         | ... | 7'41                  | ...    | ...                  | ...        | 33'04                  | Riddell House       |
| ...                | 1'83  | ...                | ...        | '65                | 16          | 11  | ...                   | 3'68   | ...                  | ...        | ...                    | Edinburgh           |
| 3'18               | 3'40  | + '22              | 107        | '83                | 16          | 17  | 11'37                 | 8'50   | - 2'87               | 75         | 44'85                  | Colmonell           |
| 2'33               | 3'94  | +1'61              | 169        | 1'05               | 16          | 16  | 8'11                  | 8'48   | + '37                | 105        | 35'80                  | Glasgow             |
| 4'36               | 6'72  | +2'36              | 154        | 1'05               | 16          | 22  | 14'79                 | 15'46  | + '67                | 105        | 57'90                  | Tighnabruaich       |
| 4'23               | 5'06  | + '83              | 120        | '53                | 4           | 25  | 14'58                 | 14'17  | - '41                | 97         | 57'53                  | Quinish             |
| 1'92               | 1'80  | - '12              | 94         | '90                | 16          | 13  | 6'12                  | 3'75   | - 2'37               | 61         | 28'95                  | Dundee              |
| 2'42               | 1'72  | - '70              | 71         | ...                | ...         | ... | 8'03                  | 5'69   | - 2'34               | 71         | 36'07                  | Braemar             |
| 2'43               | 1'53  | - '90              | 63         | '52                | 16          | 16  | 7'18                  | 5'29   | - 1'89               | 74         | 33'01                  | Aberdeen            |
| 2'16               | 2'20  | + '04              | 102        | '47                | 7           | 14  | 6'16                  | 5'93   | - '23                | 96         | 29'37                  | Cawdor              |
| 4'83               | 6'09  | +1'26              | 126        | 1'21               | 14          | 20  | 16'35                 | 19'52  | + 3'17               | 119        | 56'00                  | Invergarry          |
| 6'38               | 9'47  | +3'09              | 148        | 1'80               | 4, 14       | 21  | 21'90                 | 30'88  | + 8'98               | 141        | 86'50                  | Bendampth           |
| 2'47               | 1'99  | - '48              | 81         | '28                | 17          | 15  | 7'48                  | 9'27   | + 1'79               | 124        | 31'60                  | Dunrobin Castle     |
| ...                | 2'50  | ...                | ...        | '29                | 14          | 21  | ...                   | 9'40   | ...                  | ...        | ...                    | Castletown          |
| 4'03               | 3'07  | - '96              | 76         | 1'20               | 17          | 21  | 16'04                 | 7'83   | - 8'21               | 49         | 58'11                  | Killarney           |
| 2'55               | 1'09  | -1'46              | 43         | '36                | 16          | 18  | 9'91                  | 3'75   | - 6'16               | 38         | 39'30                  | Waterford           |
| 2'17               | 2'74  | + '57              | 126        | '53                | 15          | 20  | 7'34                  | 6'39   | - '95                | 87         | 33'47                  | Hurdlestown         |
| 2'38               | 2'34  | - '04              | 98         | '35                | 16          | 19  | 8'10                  | 5'15   | - 2'95               | 64         | 35'19                  | Abbey Leix          |
| 1'85               | 1'93  | + '08              | 104        | '74                | 19          | 19  | 5'99                  | 3'66   | - 2'33               | 61         | 27'75                  | Dublin              |
| 2'45               | 2'93  | + '48              | 120        | '55                | 16          | 24  | 8'42                  | (7'53) | - '89                | 89         | 37'04                  | Ballinasloe         |
| 5'67               | 4'76  | - '91              | 84         | 1'70               | 16          | 19  | 19'61                 | 13'05  | - 6'56               | 66         | 80'23                  | Kylemore House      |
| 3'95               | 4'84  | + '89              | 123        | 1'22               | 16          | 23  | 12'96                 | 12'07  | - '89                | 93         | 50'50                  | Enniscoe            |
| 2'56               | 3'02  | + '46              | 118        | '94                | 16          | 16  | 9'16                  | 6'45   | - 2'71               | 70         | 38'61                  | Seaforde            |
| ...                | 5'94  | +1'92              | 171        | 1'05               | 16          | 24  | ...                   | 12'99  | + 2'47               | 127        | ...                    | London              |



## SUPPLEMENTARY RAINFALL, MARCH, 1907.

| Div.  | STATION.                          | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | 1.20            | XI.    | Rhayader, Tyrmynydd .....         | ...             |
| „     | Ramsgate, West Cliff Villas ..... | .59             | „      | Lake Vyrnwy .....                 | 3.19            |
| „     | Halleham .....                    | 1.07            | „      | Llangyhanfal, Plâs Draw.....      | 1.61            |
| „     | Crowborough, Uckfield Lodge ..... | 1.37            | „      | Criccieth, Talarvor.....          | 2.17            |
| „     | Osborne, Newbarn Cottage.....     | .42             | „      | Llanberis, Pen-y-pass .....       | ...             |
| „     | Emsworth, Redlands.....           | .75             | „      | Lligwy .....                      | 2.41            |
| „     | Alton, Ashdell .....              | 1.22            | „      | Douglas, Woodville .....          | 3.39            |
| „     | Newbury, Welford Park .....       | 1.23            | XII.   | Stoneykirk, Ardwell House .....   | 3.41            |
| III.  | Harrow Weald, Hill House.....     | .98             | „      | Dalry, The Old Garroch ...        | 6.81            |
| „     | Oxford, Magdalen College.....     | .79             | „      | Langholm, Drove Road.....         | 5.28            |
| „     | Bloxham Grove .....               | .92             | „      | Moniaive, Maxwellton House .....  | 4.48            |
| „     | Pitsford, Sedgebrook.....         | 1.11            | XIII.  | N. Esk Reservoir [Penicuik] ..... | 4.50            |
| „     | Huntingdon, Brampton.....         | 1.01            | XIV.   | Maybole, Knockdon Farm.....       | 3.75            |
| „     | Wisbech, Bank House .....         | 1.02            | XV.    | Campbeltown, Witchburn.....       | 4.81            |
| IV.   | Southend Water Works.....         | .81             | „      | Inveraray, Newtown .....          | 7.81            |
| „     | Colchester, Lexden.....           | .75             | „      | Ballachulish House.....           | 8.09            |
| „     | Newport, The Vicarage.....        | .94             | „      | Islay, Eallabus .....             | 5.34            |
| „     | Rendlesham .....                  | .92             | XVI.   | Dollar Academy .....              | 4.22            |
| „     | Swaffham .....                    | 1.19            | „      | Loch Leven Sluice .....           | 3.19            |
| „     | Blakeney .....                    | 1.44            | „      | Balquhider, Stronvar .....        | 6.05            |
| V.    | Bishops Cannings .....            | .89             | „      | Perth, Pitcullen House.....       | 1.93            |
| „     | Ashburton, Druid House ...        | 1.42            | „      | Conpar Angus Station .....        | 1.73            |
| „     | Okehampton, Oaklands.....         | 1.43            | „      | Blair Atholl.....                 | 2.20            |
| „     | Hartland Abbey .....              | .88             | „      | Montrose, Sunnyside Asylum .....  | 1.31            |
| „     | Lynmouth, Rock House ...          | 1.56            | XVII.  | Alford, Lynturk Manse ...         | 1.24            |
| „     | Probus, Lamellyn .....            | 1.00            | „      | Keith Station .....               | 1.46            |
| „     | Wellington, The Avenue ...        | .74             | XVIII. | N. Uist, Lochmaddy .....          | 4.24            |
| „     | North Cadbury Rectory ...         | .58             | „      | Alvey Manse .....                 | 2.93            |
| VI.   | Clifton, Pembroke Road ...        | 1.14            | „      | Loch Ness, Drumnadrochit.....     | 2.66            |
| „     | Ross, The Graig .....             | .55             | „      | Glencarron Lodge .....            | 11.69           |
| „     | Shifnal, Hatton Grange.....       | 1.13            | „      | Fearn, Lower Pitkerrie.....       | 1.15            |
| „     | Cheadle, The Heath House.....     | 1.84            | XIX.   | Invershin .....                   | 2.11            |
| „     | Blockley, Upton Wold .....        | 1.03            | „      | Altnaharra .....                  | 3.59            |
| „     | Coventry, Kingswood .....         | 1.04            | „      | Bettyhill .....                   | 2.20            |
| VII.  | Market Overton .....              | 1.22            | „      | Watten Station .....              | 1.46            |
| „     | Market Rasen .....                | 1.81            | XX.    | Dunmanway, The Rectory.....       | 2.48            |
| „     | Rawtry, Hesley Hall.....          | .96             | „      | Cork .....                        | 1.13            |
| VIII. | Neston, Hinderton Lodge.....      | 1.90            | „      | Darrynane Abbey .....             | 2.82            |
| „     | Southport, Heaketh Park.....      | 2.70            | „      | Glenam [Clonmel] .....            | 1.59            |
| „     | Chatburn, Middlewood .....        | ...             | „      | Ballingarry, Gurteen .....        | 2.38            |
| „     | Cartmel, Flookburgh .....         | 5.16            | „      | Miltown Malbay.....               | 3.34            |
| IX.   | Langsett Moor, Up. Midhope .....  | 3.90            | XXI.   | Gorey, Courtown House ...         | .83             |
| „     | Scarborough, Scalby .....         | .97             | „      | Moynalty, Westland .....          | 2.95            |
| „     | Ingleby Greenhow .....            | .70             | „      | Athlone, Twyford .....            | 2.75            |
| „     | Mickleton.....                    | 2.24            | „      | Mullingar, Belvedere.....         | 3.26            |
| X.    | Bardon Mill, Beltingham ...       | 2.73            | XXII.  | Woodlawn .....                    | 3.88            |
| „     | Ewesley, Fallowles .....          | 2.14            | „      | Westport, Murriak Abbey.....      | ...             |
| „     | Ilderton, Lilburn Cottage.....    | 1.40            | „      | Collooney, Markree Obay.....      | 4.82            |
| „     | Keswick, York Bank.....           | 6.06            | „      | Enniskillen, Portora .....        | 4.43            |
| XI.   | Llanfrecfa Grange.....            | 2.29            | XXIII. | Warrenpoint, Summer Hill.....     | 1.80            |
| „     | Treherbert, Tyn-y-waun .....      | 4.84            | „      | Banbridge, Milltown .....         | 2.87            |
| „     | Carmarthen, The Friary.....       | 1.83            | „      | Belfast, Springfield .....        | 4.89            |
| „     | Castle Malgwyn [Llechryd].....    | 1.35            | „      | Bushmills, Dundarave .....        | 4.54            |
| „     | Plylmon.....                      | 7.20            | „      | Stewartstown, The Square.....     | 3.84            |
| „     | Tall-y-llyn.....                  | 1.40            | „      | Killybegs .....                   | 6.61            |
| „     | New Radnor, Ednol .....           | 1.90            | „      | Morn Head ...                     | 3.91            |

## METEOROLOGICAL NOTES ON MARCH, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Remarkably fine, sunny, warm and dry. The last week in particular resembled June rather than March; on each of the last 5 days the shade temp. exceeded 60°, and on the 31st reached 68°·7. Mean temp. 44°·2, or 2°·1 above the average. Duration of sunshine 151°·4 hours, and of R 28°·0 hours.

CROWBOROUGH.—Brilliant weather throughout, with mean temp. 44°·1 and R ·99 in. below the average of 36 years. On 16 days there was brilliant sunshine all day.

HARTLEY WINTNEY.—A dry month, in which cold winds and slight showers alternated so as to make the conditions seasonable rather than agreeable. From 19th to the end there was fog and frost in the mornings, with cloudless days. Ozone occurred on every day, with a mean of 4·3.

TORQUAY.—Duration of sunshine 201°·8 hours, the greatest in March since 1893; 135°·4 hours occurred on the last 13 days. Mean temp. 46°·0, or 1°·9 above the average.

CLIFTON.—Dry till 4th, followed by slight R almost daily till 19th, with westerly winds increasing to a gale on 17th and 19th. The remainder was fine, with almost continuous sunshine, high max. temp., but ground frosts at night. R less than half the average.

WORKSOP.—More sunshine than in any of the last 26 years, the max. temp. also being exceeded by 0°·1 only in 1884. The max. temp. was 66°·0 or more on each of the last 5 days. In the previous 31 years this was reached 5 times only in March, and never more than twice in one month.

BOLTON.—Such pleasant climatic conditions had not been experienced for many years. The mean temp. was with little exception above the average throughout, the mean being 42°·1, or 2°·2 above the average. Duration of sunshine 101°·4 hours, or 24°·3 hours above the average.

SOUTHPORT.—Exceptionally brilliant, and notable for high max. temp., reaching 67°·6 on 31st, the highest since 1884. Mean temp. 43°·4, or 1°·7 above the average. Duration of sunshine 178° hours, or 53 hours above the average. R ·53 in. above the average; duration, 56°·3 hours.

HAVERFORDWEST.—Fine and cold, with small R and sharp frosts. Duration of sunshine 167°·6 hours. Gale on 16th; velocity at Goodwick 80 miles per hour.

DOUGLAS.—The first week was fine and mild, succeeded by a fortnight of the worst March weather, stormy, wet and cold. Violent N.W. gale from 16th to 20th. The remainder was unusually fine and calm, with cold nights.

GLASGOW.—The first 4 days were fine but cold; then till 20th cold, stormy and wet, with S showers. From 20th was dry, clear and warm, the max. temp. reaching 50° each day.

COUPAR ANGUS.—An ideal month, particularly in the last week, when the temp. reached 60° on several days. Mean temp. 42°·1, or 3°·0 above the average.

LYNTURK.—The weather of the first half was of the same type as in January and February, S with short open intervals. The last 10 days were very fine.

DRUMNADROCHIT.—R ·35 in., and rain days 1, below the average of 21 years.

CASTLETOWN.—The first few days were fine, but from 5th to 21st rough and cold, with S, keeping back plunging. The latter part was fine, dry and sunny.

CORK.—R 1°·54 in. below the average, making a deficit of 6°·24 in. in the past three months. Mean temp. 2°·2 above the average.

DUBLIN.—A showery month with a stormy period from 13th to 20th. From 20th anticyclonic conditions prevailed. Mean temp. 46°·5. Aurora on 21st.

MARKREE.—Much H, sleet and S, with heavy R, in the first half. On 16th 1°·47 in. fell in 5 hours between noon and 8 p.m. There was much sunshine.

BELFAST.—Severe weather, except towards the end, and R nearly 2°·00 in. above the average.

## Climatological Table for the British Empire, October, 1906.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain |       | Aver. |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|------------|-------|-------|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Max. on<br>Grass. | Depth.     | Days. |       |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |      |               |           |                 |                   |            |       |       |
| London, Camden Square                                            | 71°0      | 1     | 35°4     | 26    | 61°5     | 47°6 | 50°4          | 80-100    | 108°5           | 34°4              | 3°15       | 17    | ...   |
| Malta ... ..                                                     | 81°7      | 15    | 58°1     | 29    | 75°0     | 66°4 | 62°4          | 84        | ...             | 52°9              | 8°37       | 11    | 3·5   |
| Lagos ... ..                                                     | 85°0      | sevl  | 69°0     | 14    | 84°0     | 73°6 | 73°1          | 79        | 162°0           | 68°0              | 6°91       | 14    | 6·9   |
| Cape Town ... ..                                                 | 87°5      | 31    | 41°9     | 23    | 68°3     | 51°6 | 50°1          | 63        | ...             | ...               | 1°29       | 9     | 3·3   |
| Durban, Natal                                                    | 84°9      | 21    | 53°3     | 5, 6  | 73°2     | 60°1 | ...           | ...       | 141°6           | ...               | 7°33       | 19    | 6·0   |
| Johannesburg ... ..                                              | 85°5      | 30    | 41°2     | 5     | 68°9     | 49°2 | 45°8          | 72        | 152°3           | 39°2              | 4°97       | 11    | 2·0   |
| Mauritius ... ..                                                 | 88°6      | 12    | 61°1     | 31    | 78°8     | 64°9 | 62°1          | 73        | 147°7           | 52°0              | 2°01       | 19    | 7·4   |
| Calcutta... ..                                                   | 91°7      | 4, 5  | 67°6     | 25    | 87°3     | 74°2 | 73°9          | 81        | 155°3           | 63°6              | 5°50       | 6     | 5·3   |
| Bombay... ..                                                     | 94°0      | 23    | 72°2     | 30    | 89°0     | 76°4 | 73°1          | 76        | 141°9           | 63°4              | °00        | 0     | 2·1   |
| Madras ... ..                                                    | 94°6      | 12    | 69°2     | 28    | 89°7     | 75°8 | 73°3          | 79        | 147°6           | 67°7              | 4°15       | 9     | 4·7   |
| Kodaikanal ... ..                                                | 67°2      | 10    | 47°1     | 31    | 63°6     | 51°6 | 52°5          | 89        | 144°0           | 38°3              | 7°00       | 26    | 7·1   |
| Colombo, Ceylon ... ..                                           | 87°6      | 15    | 73°2     | 28    | 84°9     | 75°3 | 73°6          | 86        | 155°2           | 71°2              | 15°80      | 27    | 7·9   |
| Hongkong ... ..                                                  | 88°9      | 2     | 65°7     | 23    | 81°0     | 71°1 | 62°1          | 62        | 141°7           | ...               | 1°32       | 3     | 4·5   |
| Melbourne ... ..                                                 | 83°8      | 28    | 37°8     | 9     | 65°7     | 48°5 | 47°2          | 73        | 149°8           | 32°4              | 2°93       | 12    | 6·6   |
| Adelaide ... ..                                                  | 95°0      | 27    | 42°0     | 31    | 71°2     | 50°6 | 48°0          | 63        | 149°3           | 37°6              | 1°66       | 12    | 4·4   |
| Coolgardie ... ..                                                | 98°6      | 20    | 39°0     | 2     | 78°7     | 50°9 | 41°9          | 43        | 164°0           | 36°8              | °00        | 0     | 2·8   |
| Sydney ... ..                                                    | 92°8      | 30    | 40°9     | 6     | 73°5     | 56°5 | 49°8          | 59        | 131°2           | 41°1              | 2°06       | 17    | 3·9   |
| Wellington ... ..                                                | 65°2      | 28    | 39°6     | 5     | 59°9     | 49°2 | 45°2          | 70        | 132°0           | 31°0              | °71        | 7     | 4·5   |
| Auckland ... ..                                                  | 69°0      | 30    | 42°0     | 2     | 63°2     | 51°2 | 47°5          | 70        | 130°0           | 36°0              | °97        | 9     | 4·9   |
| Jamaica, Negril Point.                                           | 88°8      | 26    | 69°6     | 25    | 86°4     | 73°3 | 73°5          | 79        | ...             | ...               | 9°33       | 15    | ...   |
| Trinidad ... ..                                                  | 91°0      | 23    | 67°0     | 21a   | 87°9     | 70°7 | 73°7          | 83        | 157°0           | 67°0              | 6°80       | 15    | ...   |
| Grenada ... ..                                                   | 90°4      | 27    | 70°6     | 9     | 84°4     | 74°2 | 78°8          | 80        | 155°0           | ...               | 14°20      | 19    | 4·2   |
| Toronto ... ..                                                   | 73°0      | 5     | 26°4     | 31    | 56°9     | 41°3 | 43°9          | 81        | 104°5           | 20°2              | 4°49       | 13    | 5·9   |
| Winnipeg ... ..                                                  | 72°0      | 3     | 5°8      | 30    | 52°7     | 30°8 | ...           | ...       | ...             | ...               | °21        | 3     | 6·2   |
| St. John's, N.B.                                                 | 68°6      | 10    | 34°4     | 13    | 55°8     | 42°1 | ...           | ...       | ...             | ...               | 3°13       | 11    | 4·8   |
| Victoria, B.C. ... ..                                            | 69°8      | 9     | 34°0     | 21    | 57°4     | 46°7 | ...           | ...       | ...             | ...               | 5°60       | 18    | 6·5   |
| Dawson ... ..                                                    | ...       | ...   | ...      | ...   | ...      | ...  | ...           | ...       | ...             | ...               | ...        | ...   | ...   |

a and 23.

MALTA.—Mean temp. 68°·7, or 0°·5 below the average. Mean hourly velocity of wind 7·4 miles, or 1·5 below average. Mean temp. of sea 72°·8.

Johannesburg.—Rainfall 242 per cent. of average. TSS with H were frequent in the early part of month.

Mauritius.—Mean temp. of air 0°·9 below, dew point 0°·3, humidity 3·1 per cent., and E 42 in. above, averages. Mean hourly velocity of wind 9·7 miles, or 1·3 below average.

MADRAS.—E less than half the average.

KODAIKANAL.—Bright sunshine 112 hours.

COLOMBO.—Mean temp. of air 79°·2, or 0°·9 below, of dew point 0°·6 above, E 1°10 in. above, averages. Mean hourly velocity of wind 8·0 miles. TSS on 5 days.

HONGKONG.—Mean temp. of air 75°·6. Bright sunshine 233·4 hours. E 3·4 in. below average. Mean hourly velocity of wind 11·5 miles.

Adelaide.—Mean temp. of air 1°·1 below, and E 10 in. below, averages.

Sydney.—Mean temp. of air 1°·6 above, and E 88 in. below, averages.

Wellington.—Mean temp. of air 0°·2 above, and E 3·61 in. below, averages.

TRINIDAD.—E 15 in. above 43 years' average.

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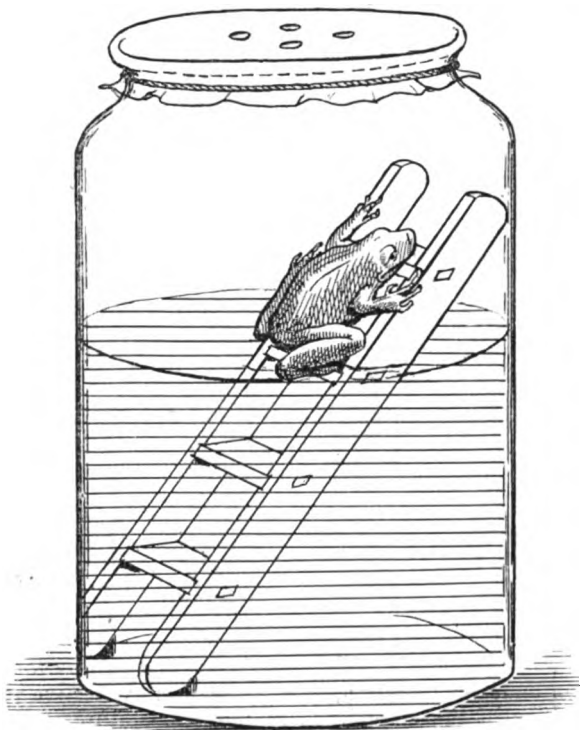
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## WEATHER WHIMS.—II.

### THE FROG'S LADDER.

BY RICHARD INWARDS.

MUCH discredit has been thrown upon the weather indications of animals, but if there is one which has retained the reputation of a prophet, albeit a croaking one, it is the green tree frog (*Hyla Arborea*).



In Germany and Switzerland this animal is commonly provided with a ladder, in a bottle half-filled with water, and he is carefully watched as to his behaviour in uncertain conditions of the atmosphere. Many observers have framed for themselves different rules based on his posture and activity. If he remained on one of the lower steps in the water it was considered a certain indication of bad weather to come; while if he emerged and sat upon the steps it was thought to foreshow fine weather, and the higher the step the finer the weather expected. He also is given to croaking loudly before a storm. Now if we look to the usual life and habits of this frog there seems really some reason to expect him to be at least experienced as regards the climatic conditions. In fine weather he skips about among the branches of the trees, actively catching flies, this goes forward all the summer, as long as there are any flies to catch. At the approach of winter he seeks the water and finds himself a bed in the mud until the following spring calls him out again to resume his fly catching occupation. He adheres to the leaves and stalks by the aid of gelatinous cushions on his toes, though precisely how he manages to release his hold so instantaneously, requires explanation. It is certain that he is a very active creature, and catches flies by rapidly protruding his tongue and drawing them into his mouth, after the manner of the toad.

The frog on the ladder, no doubt, keenly watches the weather conditions, and rises to look out for expected flies when the circumstances seem favourable. On the other hand, when the cold and damp remind him of winter he instinctively retires to bury his sorrows in the imaginary mud, which he seeks at the bottom of his prison.

I am indebted to the kindness of my friend Mr. Stroh for the outline of the frog-ladder, and for some particulars as to the behaviour of the animal.

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## CLIMATOLOGICAL OBSERVATIONS IN THE BRITISH EMPIRE IN 1905.

WE have hesitated for six months before publishing the accompanying annual summary of our monthly Climatological Table. The reason for this hesitation is not any doubt as to the accuracy or the interest of the figures themselves; but it is solely due to the tendency in the press and on the part of the public to generalize wildly on data which though suggestive are incomplete. Year after year our exposition of the annual summary has been treated by journalists on the keen hunt for sensation, as if it were an exhaustive study of the climatology of the empire. Did the temperature at Adelaide

on one summer day happen to be for a few minutes higher than the maximum recorded for the same year at Bombay, we were met the next week by a paragraph headed

#### AUSTRALIA HOTTER THAN INDIA,

and a month or two later letters of indignant repudiation reached us from the Antipodes. Did we venture in the summary to mention a few places in other continents where the absolute minimum in winter was as low as in Winnipeg, we had to write apologetic letters in reply to colonial protests against our ignorant leanings towards "the Siberian theory of Canada." The whole thing is laughably absurd. The journalistic eye rarely falls, or lingers should it fall, on the monthly or even the annual tables of plain official figures; but the moment the sense of these figures is expressed in lower case print, the unhappy words are seized upon, and crystallized into a generalization which is sometimes almost an untruth, by the ruthless suppression of explanatory statements. In fact it would not surprise us in the least if in an early batch of press-cuttings we find one founded upon the present article to this effect:—

#### "AUSTRALIA 69·9 DEGREES HOTTER THAN INDIA.

"It is asserted in a recent number of *Symons's Meteorological Magazine* that Australia is hotter than India. A considerable mass of detailed statistics is adduced in favour of this novel theory, from which we gather that the temperature in the former country was 109·7 deg., and in the latter 39·8 deg., in the year 1905."

Deductions quite as curious have been drawn from earlier articles on the Climatological Table. The fact is of course that it is impossible to condense into a journalistic crystal the truth regarding so complicated a series of phenomena as those which make up the climate of a vast area of land lying in every latitude, from within the polar circle to the equator, the more so when only twenty-five widely scattered stations are available for comparison.

It may be pointed out that imperfect as this conspectus of the climate of the empire is when one attempts by means of it to describe the infinite variations it sums up, it has appeared in our pages monthly since March, 1882, a period of more than 25 years without a break, and that no such complete statement of the climate of different parts of the King's dominions is compiled or published anywhere else. We fully appreciate its value, and are proportionately grateful to the staff of the twenty-four observatories whose punctual kindness makes the Table possible. We commend this summary of the twelve monthly tables for 1905 to our readers, with the foregoing apology for the omission of the descriptive article which used formerly to appear on the occasion.



CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1905.

| STATIONS.         | ABSOLUTE. |                  |       | AVERAGE. |                               |      |      |       |               | ABSOLUTE. |                 | RAINFALL.         |               | AVER.<br>AGE.<br>Cloud. |             |
|-------------------|-----------|------------------|-------|----------|-------------------------------|------|------|-------|---------------|-----------|-----------------|-------------------|---------------|-------------------------|-------------|
|                   | Maximum.  |                  | Temp. | Minimum. | Date.                         | Max. | Min. | Mean. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.<br>in. |                         | Days.       |
|                   | Temp.     | Date.            |       |          |                               |      |      |       |               |           |                 |                   |               |                         |             |
| London .....      | 85.3      | July 26          | 21.2  | ...      | January 16                    | 58.2 | 43.4 | 50.8  | 46.2          | 83        | 134.6           | 17.5              | 22.97         | 162                     | 0-10<br>6.4 |
| Malta .....       | ...       | ...              | ...   | ...      | ...                           | ...  | ...  | ...   | ...           | ...       | ...             | ...               | ...           | ...                     | ...         |
| Lagos .....       | 93.0      | Mar. 9, 13, 14   | 69.0  | ...      | { Feb. 6, Jun. 13,<br>Oct. 16 | 86.0 | 75.0 | 80.5  | 73.2          | 76        | 146.0           | 60.0              | 65.11         | 122                     | 6.2         |
| Cape Town .....   | 98.1      | January 16       | 38.2  | ...      | August 15                     | 69.9 | 54.4 | 62.1  | 53.4          | 73        | ...             | ...               | 30.15         | 102                     | 4.3         |
| Durban, Natal.    | 90.7      | December 18      | 45.4  | ...      | June 14                       | 78.1 | 61.4 | 69.8  | ...           | ...       | 154.2           | ...               | 44.95         | 153                     | 4.8         |
| Johannesburg...   | 87.8      | October 18       | 28.7  | ...      | June 12                       | 69.4 | 49.6 | 59.5  | 46.0          | 69        | 164.0           | 12.0              | 23.05         | 101                     | 2.9         |
| Mauritius .....   | 89.0      | November 17      | 52.3  | ...      | August 2                      | 80.8 | 67.4 | 74.1  | 66.3          | 79        | 156.4           | 42.7              | 68.03         | 207                     | 6.5         |
| Calcutta .....    | 106.1     | June 16          | 45.9  | ...      | February 10                   | 85.9 | 69.8 | 77.9  | 68.6          | 75        | 166.2           | 39.9              | 69.76         | 91                      | 5.1         |
| Bombay .....      | 94.7      | October 8        | 56.1  | ...      | January 31                    | 86.0 | 74.4 | 80.2  | 70.4          | 74        | 144.5           | 47.3              | 33.66         | 89                      | 3.9         |
| Madras .....      | 107.9     | May 29           | 57.4  | ...      | January 29                    | 91.7 | 75.3 | 83.5  | 71.3          | 73        | 152.1           | 52.8              | 42.72         | 85                      | 4.5         |
| Kodaikanal .....  | 74.7      | May 5            | 39.8  | ...      | January 29                    | 85.1 | 51.1 | 58.1  | 48.5          | 74        | 149.0           | 18.5              | 69.96         | 164                     | 5.3         |
| Colombo .....     | 93.7      | March 6          | 67.2  | ...      | January 14                    | 87.1 | 75.9 | 81.5  | 73.6          | 80        | 157.5           | 61.5              | 65.31         | 168                     | 5.4         |
| Hong-Kong .....   | 91.3      | July 18          | 42.8  | ...      | February 10                   | 76.0 | 67.9 | 72.0  | 65.3          | 80        | 148.5           | ...               | 70.98         | 145                     | 7.1         |
| Melbourne .....   | 108.5     | Jan. 11, 13      | 32.0  | ...      | Aug. 2, Sep. 18               | 66.2 | 49.0 | 57.6  | 46.7          | 72        | 165.4           | 24.5              | 25.64         | 129                     | 6.2         |
| Adelaide .....    | 109.7     | January 12       | 34.8  | ...      | August 21                     | 70.2 | 51.3 | 60.8  | 46.9          | 62        | 168.4           | 30.3              | 22.28         | 131                     | 4.9         |
| Geelong .....     | 108.5     | January 20       | 32.4  | ...      | August 11                     | 76.5 | 51.1 | 63.8  | 45.2          | 52        | 178.8           | 24.2              | 7.86          | 58                      | 3.3         |
| Sydney .....      | 98.1      | November 17      | 38.6  | ...      | July ...                      | 69.5 | 55.4 | 62.5  | 51.1          | 71        | 134.9           | 29.3              | 35.03         | 216                     | 4.7         |
| Wellington .....  | 77.0      | February 5       | 30.5  | ...      | June 5                        | 60.3 | 49.2 | 54.8  | 46.4          | 74        | 139.0           | 27.0              | 51.07         | 175                     | 6.3         |
| Auckland .....    | 78.5      | January 19       | 37.0  | ...      | June 5                        | 63.6 | 51.9 | 57.7  | 50.1          | 76        | 143.0           | 31.0              | 39.82         | 173                     | 5.1         |
| Jamaica .....     | 91.6      | July 15, 19      | 62.9  | ...      | January 27                    | 85.9 | 71.6 | 78.7  | 71.9          | 79        | ...             | ...               | 55.24         | 112                     | ...         |
| Grenada .....     | 89.4      | Apr. 1, Aug. 13  | 68.0  | ...      | February 1                    | 83.3 | 73.8 | 78.6  | 71.6          | 77        | 154.0           | ...               | 77.89         | 244                     | 3.9         |
| Toronto .....     | 92.1      | July 18          | 8.2   | ...      | February 4                    | 53.5 | 36.5 | 45.0  | 38.2          | 78        | ...             | ...               | 31.26         | 140                     | 5.9         |
| Fredericton ..... | 88.7      | June 16, Aug. 12 | 33.5  | ...      | January 15                    | 61.8 | 28.2 | 40.0  | 27.1          | 57        | ...             | ...               | 32.69         | 105                     | 5.3         |
| Winnipeg .....    | 86.8      | July 10          | 39.1  | ...      | January 10                    | 46.8 | 25.4 | 36.1  | ...           | ...       | ...             | ...               | 20.36         | 96                      | 5.0         |
| Victoria, B.C.    | 84.2      | July 8           | 22.7  | ...      | February 12                   | 55.7 | 44.6 | 50.2  | ...           | ...       | ...             | ...               | 22.98         | 140                     | 5.9         |
| Dawson .....      | 85.7      | June 24          | 50.5  | ...      | January 26                    | 33.6 | 16.8 | 25.2  | ...           | ...       | ...             | ...               | 15.44         | 79                      | ...         |

**STORMS AND THE SOURCES OF THEIR ENERGY.**

By D. T. SMITH, M.D., Louisville, Kentucky.

NOTWITHSTANDING the diligent research of recent years, there still remains a number of questions unsettled relating to the origin and working of cyclones.

Since the heated air arising every day from islands that experience a sea-breeze must take the form of a cyclone, and since a large proportion of cyclones is known to originate in regions of the ocean where islands abound, it is worth while to inquire whether or not the origin of most, if not all, cyclones can be traced to the gyrating masses of air that rise daily from tropical islands. To this question time and observation must bring the answer. The full discovery of the source of the energy of cyclones must, however, continue to depend largely on inference and reasoning. The energy released in the form of heat by condensing vapour is no longer considered by the best thinkers at all adequate to the production of the tremendous dynamic results witnessed in cyclonic movement.

In addition to the energy that may be derived from the classic source of condensation of moisture, there appear at least two other sources of energy deserving of consideration. One of these is the momentum with which the trade winds rise as they recurve along the borders of the doldrums to become the anti-trades, and later the prevailing easterlies of temperate zones, and the other the decapitation of cyclones by the prevailing overcurrent.

As long as the cyclone is moving to the westward along the line of the trade winds and the doldrums, the ascending trades must continuously enter into and be incorporated with it, carrying with them the energy of their momentum. But the vast preponderance of the energy of cyclones, both for rotation and progression, would seem to be derived from their decapitation by the prevailing overcurrent.

The principle upon which this may be effected is well exhibited in the well-known machine designed for spraying perfumes, but now largely employed by medical men and painters. This well-known instrument consists of two tubes—a horizontal and an upright one—set at right angles to each other in such a way that air blown through the horizontal tube is projected immediately over the upper extremity of the upright tube. The upright tube extends down into the liquid to be sprayed, and when air is blown through the horizontal tube the liquid rises up and is driven onward as spray. This rising of the liquid indicates that the air has been removed from the end of the upright tube faster than it can descend, and that a partial vacuum has been produced at that point.

A cyclone may be regarded as a mountain of atmosphere lifted up to a certain degree by the momentum of the inrush of air at its base, and to this extent it is constituted a "low."

But the top of this mountain is continuously torn off and carried



away forward by the upper or anti-trades, if it is near the tropics, and by the constant easterly overcurrent if it is in the temperate zones. The decapitated mountain, already hollowed out at its base as it is, as regards its gravity, by the momentum of the upward moving core, is thus constituted doubly a "low," into which the air around is constantly pressed.

It is obvious that if the horizontal trajectory of the prevailing overcurrent were equal to the rate of descent of the air above the line of decapitation, the barometric pressure at the Earth's surface over such area would be that due to the weight of the air below that level, or probably about sixteen inches of mercury. But it is rare that the depression in the centre of a cyclone amounts to as much as one inch of mercury, and this ought easily to be effected by the overcurrent moving at the rate of 200 or more miles an hour.

The energy imparted to the cyclone by this continuous decapitation may also be invoked to explain its progression. Since the speed of successive strata of the overcurrent is progressive from below upward, the decapitation of the cyclone must be accompanied by a dragging action that causes the upper part of its mass to lean forward in the direction of advance. This leaning gives to the mass of atmosphere entering the cyclone form in front, an advantage over that coming into it from the rear. That is to say, even if it were stationary, a mass of air starting from the Earth's surface in front of it, would reach a given point on its body in less time than a like mass starting from a place equally removed in the rear could reach a corresponding point; and still more must this be the case when the cyclone is advancing.

This must result in re-forming the centre continuously in advance; and since the centre of gravity thus continuously advances, the whirling cyclone must also advance in order that its axis of rotation may continue coincident with its centre of gravity.

The uniform occurrence of anticyclones on the north-western quadrant of cyclones would seem to indicate a causal relation between the two, and suggests an enquiry as to whether the pursuing anticyclone does not derive its energy from the cyclone.

The rotation of the cyclone in temperate regions carries the mass constituting its poleward rim full against the prevailing overcurrent, and this must have the effect of damming back or heaping up the air on its poleward side. To the extent to which this might happen, and the extent to which the air might be drawn into the narrowing meridians to the north, there would be produced a "high" or anti-cyclone.

It is also a question whether the increased radiation of heat from a clear atmosphere may not also be a source of energy. The contraction of an anticyclonic mass, due to loss of temperature by radiation, would result in a descent with a momentum corresponding to the average descent of its particles, and this must to an equal extent affect the barometer.

The breeze blowing out from the shadow of an eclipse may be largely, if not wholly, due to such a cause. The air round the area of the shadow could hardly be supposed to flow into the depression due to the contraction in the short time available rapidly enough to be the cause of the outflow.

The momentum of the air descending in a cyclone, and reacting as it is deflected at the Earth's surface, would also seem to some extent to increase the barometric pressure.

In the case of tornadoes also, the energy may be due to the beheading effect of transverse currents derived from cyclones, and it may be occasionally from anticyclones. Where tornadoes spring from cyclones rising masses of air with their energy might become incorporated with them, but this could not well occur in the case of such as grow out of anticyclones.

### THE RAINFALL OF APRIL, 1907.

THE remarkable dryness which prevailed in most parts of the country during January, February and March, has been in some measure redressed by the heavy rainfall of the south of England in April.

Our Tables show that the wettest part of the country in relation to the average was the centre of the south of England from the river Thames southward, though not reaching to the coast. Over most of the counties which have the Thames as their northern boundary and westward into Wiltshire more than twice the normal rainfall for April fell. The Rev. H. A. Boys, writing from North Cadbury before the end of the month, remarked, "the first week of April was wetter than February, the second week was wetter than January, the third week was wetter than March, and the three first weeks of April had an inch more rain than the first quarter of the year." Throughout the greater part of the south of England April had more rain than the three preceding months.

A broad belt of the north of England from North Wales to the North Riding of Yorkshire had less than the average rainfall, in some parts not two-thirds of the average, and a similar dry belt crossed Scotland from Cantyre to Aberdeen. To our deep regret the observers, on whose enthusiastic interest we have relied for many years for observations at Colmonell in the south-west and at Riddell House in the south-east of Scotland, have been removed by death, and our summary of the month is rendered incomplete.

In considering the four months of the current year, we find that the only part of England in which the rainfall has appreciably exceeded the average is in Norfolk and the north of Suffolk. In Scotland the western half of the country, and in Ireland the extreme north, have also had more than the normal rainfall. The driest parts of the British Isles for the four months have been three narrow strips on the coast, in each of which less than 75 per cent. of

the average rainfall was recorded. These were (1) the east coast of Scotland and England from Aberdeen to Hull, (2) the western promontories of North Wales, South Wales, and probably Cornwall, and (3) the south coast of Ireland.

### ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday evening, April 17th, at the Institution of Civil Engineers, Great George Street, Westminster, Dr. H. R. Mill, President, in the chair.

A paper by Mr. R. L. Holmes, on the "Phenomenal Rainfall in Suva, Fiji, August 8th, 1906," was read by the Secretary in the absence of the author. This was an account of a very remarkable fall of rain which occurred during a thunderstorm at Suva, the capital of Fiji, on the night of August 8th. Unfortunately the exact amount had to be, in part, estimated, owing to the observer failing to measure the fall at intervals during the night. Very little rain fell before sunset, but from 6 p.m. it continued a ceaseless downpour until sunrise the next day. At 10 p.m. the gauge was found overflowing, with 12.50 in. of rain in it. Four hours later, at 2 a.m., on the 9th, the gauge was again overflowing, and at 6 a.m. it was overflowing once more; that is three times in 12 hours. Very little rain fell after 6 a.m. These measurements show a fall of over 37 inches, without taking into account the overflows, which are an unknown quantity. As the gauge was 25 feet above the ground, Mr. Holmes is of opinion that the rainfall should be increased by about 11 per cent., and he calculates that the total fall must have been fully 41 inches in about 13 hours, which he thinks surpasses anything that had been recorded in any other part of the world in so short a space of time.

An interesting discussion followed the reading of this paper. Mr. Bayard and Captain Hepworth thought it was a pity that Mr. Holmes had not told them more about the rain gauge, and also about the construction of the roof.

Mr. Bentley said that the paper once more illustrated the necessity for the larger and adequate capacity of rain gauges, and more especially in tropical countries.

Mr. Bryant said that they found at the Royal Observatory, Greenwich, that a rainfall on the roof showed a deficiency compared with a rainfall near the ground, varying from 100 per cent. to nothing, or even less, according to the rate of fall and other conditions.

Mr. Marriott said that he would like to have known something of the atmospheric conditions prevailing at the time. If an isobaric chart had been prepared, they would probably have had some information as to the conditions under which the rain fell. The question of the percentage to be added for the rain gauge being 25 feet above the ground would depend upon the character of the wind at the time.

The President said that the amount of rain collected in high and low gauges varied extremely under different circumstances. In very heavy rain there was less difference in the catch of high and low gauges than in light rain, and in heavy rain, in still weather, actually more rain had sometimes been caught at a great elevation than on the ground. The total amount of wind in the twenty-four hours during which the remarkable fall occurred, was 96 miles, averaging only 4 miles per hour. This was very little, and one would expect that the amount of rain falling at 25 feet above the ground would be very nearly the same as at one foot, so that the 11 per cent. addition was probably unnecessary, or at least it was too great.

A paper by Mr. R. Strachan on the "Temperature around the British Islands in relation to the Gulf Stream," was read by the Secretary. This was based on observations made in the year 1906, which have been published by the Meteorological Office. Around the British coasts the temperature of the air was lowest in February, and highest in August; the temperature of the sea corresponded to these epochs with slight interruptions, having been lowest in January for the west and central, in March for the south, and highest in September for the north, and in July for the east, positions. The water in the Strait of Florida was about 30° warmer than the sea at the north of Scotland.

Captain Hepworth, Dr. Dickson, Mr. Matthews, Dr. Theodore Williams, and the President, took part in the discussion, and Mr. Strachan replied.

Mr. L. C. W. Bonacina also read a paper on "Weather regarded as a function of Climate," in which he dealt with the philosophy of the science.

Dr. Shaw, Mr. Strachan, Mr. J. E. Clark, Mr. Bryant, and the President, said a few words on the subject of the paper, and Mr. Bonacina replied.

The following gentlemen were elected Fellows of the Society:—  
Mr. C. A. O. Buyzer, Mr. D. W. Freshfield, Mr. A. P. Harcourt, Mr. J. E. H. Hill, B.Sc., Mr. W. C. Lane, Capt. C. W. D. Lynch, Capt. S. C. Peacock, Mr. S. M. Shafi, Mr. J. Turner, Mr. T. Tyrwhitt, and Mr. P. D. Warren, Assoc.Inst.C.E.

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

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### THE PAST WINTER IN AUSTRIA.

I NOTICE in the last issue of your Magazine that you have experienced remarkably fine weather during the month of March. With us the weather was abominably cold and wet, with much snow in the

mountains. In the northern Alps the people do not remember a winter with such quantities of snow as that which is just past. Avalanches have wrought havoc, and are still of frequent occurrence. All communications by the Arlberg route, both by road and rail, were completely interrupted for more than a fortnight. Even yet the weather continues cool and rainy.

J. HANN.

*Wien, 20th April, 1907.*

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## WHAT IS THE MAXIMUM TEMPERATURE OF A DAY?

IN the discussion of the records of a Callendar electrical temperature recorder in the Transvaal, there occasionally arises some uncertainty as to the meaning of the term "maximum temperature of the day." The normal daily temperature record resembles a simple sine curve with a definite maximum at about 3 p.m., and a well-marked minimum about 5 a.m. These conditions allow of no ambiguity as to the meaning of the term "maximum temperature," as this temperature is represented by the peak of the curve. It also satisfies the mathematical definition of a maximum value, in that it is greater than all temperatures in the immediate neighbourhood of it on either side. But occasionally there are days on which the whole of the High Veldt is enveloped in a thick wet mist, through which the sun does not penetrate during the whole time it is above the horizon. On such days the temperature may fall continuously from midnight, and reach its lowest point during the afternoon, and then slowly rise again during the night. Hence the temperature record approximates to a smooth curve which is wholly concave upwards. Considering temperature as a single-valued continuous function of time, such a curve possesses no maximum, and hence, strictly speaking, there is no maximum temperature on that particular day. However, although not possessing a maximum value, a continuous function must possess a greatest and least value, but to specify these, definite limits must be given to the range of the function. At the majority of the stations in the Transvaal, thermometric observations are taken only once a day, viz., at 9 a.m., and the reading of the maximum thermometer, as then read, is entered to the previous day. But when a bright day follows a damp misty day, the temperature of the air at 9 a.m. is frequently several degrees higher than the highest temperature of the previous day. Hence the reading of the maximum thermometer at that time is not a correct representation of the conditions of the previous day. This being so, would it not be advisable in determining the mean maximum temperature of a station for a month or a year, to leave out all those readings of the maximum thermometer which were not greater than the readings of the dry bulb thermometer at 9 a.m., and similarly all readings of the minimum thermometer which were not lower than this reading? This process

should give a more correct value to the means of the maximum and minimum temperatures.

Where the maximum temperatures are obtained from continuous records, and the curve has a crest lying within the limits midnight—midnight, then the temperature corresponding to the crest should be taken as being the maximum temperature of the day, although this might possibly be lower than the temperature at either midnight.

H. E. WOOD.

*Transvaal Meteorological Department, Johannesburg,  
22nd April, 1907.*

[The same difficulty arises not infrequently in the British Isles, especially in winter when the temperature of the air depends less on solar radiation than on the direction of the wind; but we believe that most meteorological observers use the words maximum and minimum as synonymous with highest and lowest, irrespective of the form of the curve of diurnal temperature. The highest temperature has sometimes to be entered to a day on which it did not occur or it would not be entered at all, though obviously when the highest temperature occurs at or before 9 a.m. it has not the normal character of a daily maximum.—ED., *S.M.M.*]

## REVIEWS.

*Grundzüge einer Theorie der synoptischen Luftdruckveränderungen*  
[Principles of a Theory of Synoptic Weather Changes]. Von DR.  
FELIX M. EXNER. Aus dem Sitzungsberichten k. Akad. Wiss.  
Mathem.-naturw. Klasse. Bd. CXV. Abt. IIa. Wien, 1906.  
Size  $9\frac{1}{2} \times 6\frac{1}{2}$ . Pp. 76.

TAKING advantage of the numerous records of self-registering instruments in different parts of the United States preserved in the Weather Bureau at Washington, Dr. Exner prepared a series of isobaric and isothermal charts for the month of January, 1895, for every four hours, i.e., six of each set of charts for each of 31 consecutive days. By the study of these charts representing atmospheric conditions over a very wide area at short intervals of time, the process by which the consecutive changes resulting in the movement of centres of high and low pressure are effected, is ascertained. The result is subjected to mathematical discussion, and use is made especially of the height at which the variations of pressure from day to day shown in the charts ceases to be felt. The whole work is preliminary to a detailed study of similar conditions in Europe, where on account of the number of agencies at work and the diversity of the hours of observation, the problem is more difficult to attack than in America, where uniformity of observation prevails over an immense area.

*Meteorological Observations at Bulawayo.* By REV. E. GOETZ, S.J. Bulawayo, 1906. Size  $8\frac{1}{2} \times 5\frac{1}{2}$ . Pp. 30.

THE Meteorological Observatory kept up by Father Goetz at Bulawayo has already been described in these pages (Vol. 40, 1905, p. 205). We have received the pamphlet named above, which is reprinted from the *Proceedings of the Rhodesian Scientific Association*, and contains a full account of the records tabulated for the years 1897 to 1904. The striking feature about all the figures except rainfall is the remarkable uniformity from year to year. The mean temperatures, for instance, of the seven complete years running  $66^{\circ}\cdot7$ ,  $67^{\circ}\cdot6$ ,  $68^{\circ}\cdot3$ ,  $67^{\circ}\cdot2$ ,  $67^{\circ}\cdot3$ ,  $67^{\circ}\cdot4$ ,  $65^{\circ}\cdot5$ , so that there is every reason to believe that the average of the seven years,  $67^{\circ}\cdot3$ , is very close to the normal temperature of the locality. Rainfall varied from 17·58 in. in 1899 to 29·35 in. in 1901, and the alternation of the seasons was so marked that the average duration of the wet season was five months five days, with 21·19 in. of rain falling on 62 days, while the average dry season was six months twenty-five days, with only 1·12 in. falling on 9 days. The rainfall at Hope Fountain, 10 miles S. of Bulawayo, for the years 1898 to 1904 is also quoted.

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*Cape of Good Hope. Report of the Meteorological Commission for the year ending 31st December, 1904.* Cape Town, 1906. Size  $13 \times 8\frac{1}{2}$ . Pp. 120.

THE number of stations for rainfall observation in Cape Town had risen to 523 in the year 1904, but it is pointed out in this report that twice that number of rain gauges uniformly distributed over Cape Colony would barely suffice to enable the average distribution of rainfall over the country to be determined with a reasonable degree of accuracy. It is stated that rain gauges are particularly required in the mountainous districts, where recent investigations have shown that the amount of precipitation may be so enormous as to be almost incredible. We hope in an early number of the Magazine to refer at some length to the remarkable wetness of some of the valleys in the extreme south of Cape Colony.

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*Meteorological Observations made in Western Australia in 1904.* Under the direction of W. ERNEST COOKE, M.A., F.R.A.S. Perth, 1906. Size  $13 \times 8\frac{1}{2}$ . Pp. 144.

THE Meteorological Department in Western Australia devoted attention to weather forecasts as well as to the collection of data, and Mr. Cooke notes with very reasonable satisfaction that the percentage of general forecasts for the whole State issued at 4 p.m., and published in the daily papers the following morning, came out as 90 correct, and only 2 wrong, while the special forecasts for Perth and neighbourhood issued at 9 a.m., were correct in 94 per cent. of the cases, and only wrong in one.

*Meteorologische Zeitschrift. Hann-Band. Zum vierzigjährigen Redaktionsjubiläum J. Hann's von Freunden und Kollegen gewidmet: redigiert von DR. J. M. PERENTER, Wien, und Dr. G. HELLMANN, Berlin.* [The Hann Volume, dedicated by the friends and colleagues of J. Hann, on the occasion of the fortieth anniversary of his editorship of the *Meteorologische Zeitschrift*. Edited by Dr. J. M. Pernter, of Vienna, and Dr. G. Hellmann, of Berlin.] Braunschweig, 1906. Size 12 × 8. Pp. x. + 404.

It is usual in this country for the colleagues of a scientific man to pay him very handsome tributes of respect and appreciation in the form of obituary notices, not infrequently written in advance, and it is probable that many eminent persons would be agreeably surprised by the warmth of the expressions of their contemporaries' good-will were they privileged to peer into the columbaria of the newspaper offices' "graveyards." On the continent they have a more excellent way, and a favourite method of showing honour to a distinguished worker is for his friends and colleagues to mark some epoch in his life by the presentation of a volume compiled by them on the subject of his studies. That now before us is a typical example, and nothing in the way of a testimonial could be more appropriate than this substantial supplementary volume of the *Meteorologische Zeitschrift*, a publication which, thanks mainly to Dr. Hann's forty years of editorship, is recognised as the leading organ of meteorology in the world. There are, altogether, forty-two memoirs, most of them in German, but some in English or French, representing no less than thirteen different countries. It is impossible to enumerate them all, and we content ourselves with citing those which are given in English, viz. :—

Sir John Eliot.—Brief discussion of the observations of the solar radiation (or black bulb in vacuo) thermometers in India during the period 1892–1903.

W. N. Shaw.—The law of sequence in the yield of wheat for Eastern England.

Cleveland Abbe.—The trade winds and the doldrums.

A. Lawrence Rotch and L. Teisserenc de Bert.—The meteorological conditions above the tropical North Atlantic.

*Cold Waves and Frost in the United States.* Prepared under direction of Willis L. Moore, Chief U.S. Weather Bureau. By EDWARD B. GARRIOTT, Professor of Meteorology. Washington, 1906. Size 11½ × 9½. Pp. 22 + 328 charts. Price 30 cts.

A SHORT account is given of historical cold periods in the United States from 1717 onwards, and then a series of charts shows the isobars and isotherms of consecutive days in a large number of "cold waves" from 1888, each series extending over the period during which the "cold wave" was moving across the country.



*Reduction of Greenwich Meteorological Observations. Part IV. Temperature of the Air as determined from the observations and records of the 15 years 1891 to 1905 made at the Royal Observatory, Greenwich. Now collected and discussed under the direction of SIR W. H. M. CHRISTIE, K.C.B., M.A., F.R.S., Astronomer Royal. Edinburgh, 1906. Size  $12\frac{1}{2} \times 9\frac{1}{2}$ . Pp. 68, price 3s.*

A FRONTISPIECE is given showing the curves of the mean temperature, the mean maximum, and the mean minimum and extreme maximum and extreme minimum of the air for each day of the year on the average of the period 1841 to 1905. A series of tables gives the daily means of temperature for each month so far as regards the daily mean maximum, minimum and range for the period 1891 to 1905, with the highest, lowest and mean values for the 65 years, 1841 to 1905. The memoir is thus a supplement to the volume published in 1895, which dealt with the temperature of the air from 1841 to 1890; but it is more than this, because it makes a comparison between the 50 and 65 years, and gives, amongst many others, a table of the smoothed values of mean temperatures for the 65 years. A large number of other tables represent the data in every conceivable form in which they seem likely to be useful. We propose to give a summary of the constants of temperatures from this memoir in a future number.

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*Bericht über die Internationale Meteorologische Direktorenkonferenz in Innsbruck, September, 1905. (Report of the International Conference of Directors of Meteorological Institutions at Innsbruck). Wien, 1906. Size  $11 \times 7\frac{1}{2}$ , pp. 154.*

THIS is the official report of the meeting of Directors of Meteorological Institutions which took place in Innsbruck, in 1905, on the initiative of the International Meteorological Committee. It contains a report of the proceedings at the meeting, the reports of various committees on matters relating to meteorology and terrestrial magnetism, and also a series of appendices dealing with many points of great interest, concerning which additional information is required and international co-operation desirable. Want of space alone prevents us from referring in detail to the points brought forward.

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*Rainfall at Ashburton. Forty Years' Record, by P. F. S. AMERY. (Reprinted from Trans. Devonshire Association, 1906). Size  $8\frac{1}{2} \times 5\frac{1}{2}$ . Pp. 8 + 3 plates.*

A DISCUSSION of a valuable rainfall record on the south-eastern slope of Dartmoor, the author apparently not being the observer. Some emphasis is laid upon the 40 years' record yielding a driest year somewhat wetter than that usually assumed as the lowest likely to occur; but without information as to the pattern and exposure of the rain gauge (which is not given) no valid conclusion can be drawn.

*Meteorology in Mysore, 1905. Thirteenth Annual Report.* Pp. 56.

*Report on Rain Registration in Mysore for 1905.* Pp. 30. By JOHN COOK, M.A., F.R.S.E. Bangalore, 1906. Size  $12 \times 9\frac{1}{2}$ .

THE general Report contains a frontispiece showing the large and handsome building of the Mysore Government Central Observatory at Bangalore, and the observations of the year are discussed in considerable detail. The Rainfall volume contains a map of Mysore province showing the average annual rainfall for the 36-years' period, 1870—1905. This map would have gained in clearness if the shading indicating the areas of increasing rainfall had been made of increasing darkness, and not simply depending as they do on lines running at different angles. The map also appears in red instead of blue, the usual livery of rainfall maps. There is no reason why it should not be red, but at the same time the familiar colouring would afford a certain help to the eye in following the distribution.

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### METEOROLOGICAL NEWS AND NOTES.

DEATH OF DR. BUCHAN.—At the moment of going to press we learn with profound regret of the death of Dr. Alexander Buchan, F.R.S., which occurred at Edinburgh on May 13th. A sketch of Dr. Buchan's career as a meteorologist will be given in an early number.

DR. DOBERCK, Director of the Hong Kong Observatory, is, we are informed by *The Observatory*, about to retire from that position, which he has occupied since the year 1883.

A SELF-REGISTERING SNOW GAUGE is described by Dr. Hellmann in a recent number of the *Meteorologische Zeitschrift* (1906, Heft 8). The principle is that of a balance, like the Casella recording rain gauge. This Chionograph has a funnel surface of 64 square inches, all the snow entering which falls on the pan of a balance with a fixed counterpoise at the end of a curved lever, and the descent of the pan, which is always in equilibrium, as the weight on it increases, actuates a pen working on a drum as in the common aneroidograph. The pen has a range corresponding to 1.38 in. of rain, and then automatically drops to zero and makes a second ascent of the drum. Should more snow than corresponds to 2.76 in. of rain fall (i.e., more than about 2 feet), it is necessary to change the receiving vessel on the plate of the balance.

## TEMPERATURE FOR APRIL, 1907.

| STATION.                            | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |       |      |        | No. of Night<br>frost below 32° |       |
|-------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|-------|------|--------|---------------------------------|-------|
|                                     |                      |            |                      |                                | Max.         |       | Min. |        | Shade.                          | Grass |
|                                     |                      |            |                      |                                | °            | Date. | °    | Date.  |                                 |       |
| Camden Square.....                  | London.....          | 51 32      | 0 8                  | 111                            | 73·4         | 24    | 30·8 | 19     | 1                               | 7     |
| Tenterden.....                      | Kent.....            | 51 4       | 0 41                 | 190                            | 71·0         | 24    | 30·0 | 19     | 2                               | 15    |
| West Dean.....                      | Hampshire.....       | 51 3       | 1 38                 | 137                            | 70·0         | 24    | 26·0 | 20     | 10                              | 21    |
| Hartley Wintney.....                | ".....               | 51 18      | 0 53                 | 222                            | 73·0         | 2, 24 | 29·0 | 19, 20 | 7                               | 12    |
| Hitchin.....                        | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | 70·0         | 1     | 28·0 | 19     | 5                               | ...   |
| Winslow (Addington).....            | Buckinghamsh. r.     | 51 58      | 0 53                 | 309                            | 69·0         | 1, 24 | 29·0 | 18     | 5                               | 13    |
| Bury St. Edmunds (Westley).....     | Suffolk.....         | 52 15      | 0 40                 | 226                            | 69·0         | 1, 24 | 27·0 | 19     | 4                               | ...   |
| Brundall.....                       | Norfolk.....         | 52 37      | 1 26                 | 66                             | 67·4         | 24    | 29·4 | 20     | 3                               | 11    |
| Winterbourne Steepleton.....        | Dorset.....          | 50 42      | 2 31                 | 316                            | 69·0         | 24    | 28·5 | 4      | 5                               | 11    |
| Torquay (Cary Green).....           | Devon.....           | 50 28      | 3 32                 | 12                             | 69·0         | 24    | 35·2 | 18     | 0                               | 6     |
| Polapit Tamar [Launceston].....     | ".....               | 50 40      | 4 22                 | 315                            | 64·0         | 1     | 30·6 | 5      | 3                               | 13    |
| Bath.....                           | Somerset.....        | 51 23      | 2 21                 | 67                             | 67·0         | 1, 24 | 29·5 | 20     | 4                               | ...   |
| Stroud (Upfield).....               | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 67·0         | 24    | 35·0 | 17     | 0                               | ...   |
| Church Stretton (Woolstaston).....  | Shropshire.....      | 52 35      | 2 48                 | 800                            | 64·5         | 1, 24 | 20·0 | 18     | 23                              | ...   |
| Bromsgrove (Stoke Reformatory)..... | Worcestershire.....  | 52 19      | 2 4                  | 225                            | 65·0         | 1     | 26·0 | 17     | 9                               | ...   |
| Boston.....                         | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 68·0         | 1     | 30·0 | 18†    | 6                               | ...   |
| Workshop (Hodsock Priory).....      | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 67·3         | 1     | 28·9 | 18     | 6                               | 15    |
| Derby (Midland Railway).....        | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 69·0         | 1     | 30·0 | 17     | 3                               | ...   |
| Bolton (Queen's Park).....          | Lancashire.....      | 53 35      | 2 28                 | 390                            | 63·0         | 2     | 28·4 | 18     | 1                               | 10    |
| Wetherby (Ribston Hall).....        | Yorkshire, W. R.     | 53 59      | 1 24                 | 130                            | ...          | ...   | ...  | ...    | ...                             | ...   |
| Arnccliffe Vicarage.....            | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...   | ...  | ...    | ...                             | ...   |
| Hull (Pearson Park).....            | " E. R.              | 53 45      | 0 20                 | 6                              | 66·0         | 24    | 28·0 | 19     | 2                               | 8     |
| Newcastle (Town Moor).....          | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...   | ...  | ...    | ...                             | ...   |
| Borrowdale (Seathwaite).....        | Cumberland.....      | 54 30      | 3 10                 | 423                            | 59·8         | 2     | 26·8 | 18     | 4                               | ...   |
| Cardiff (Ely).....                  | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...   | ...  | ...    | ...                             | ...   |
| Haverfordwest (High Street).....    | Pembroke.....        | 51 48      | 4 58                 | 95                             | 62·0         | 24    | 32·2 | 5      | ...                             | 5     |
| Aberystwyth (Gogerddan).....        | Cardigan.....        | 52 26      | 4 1                  | 83                             | 65·0         | 24    | 26·0 | 19     | ...                             | ...   |
| Llandudno.....                      | Carmarvon.....       | 53 20      | 3 50                 | 72                             | 63·0         | 2     | 31·2 | 18     | 1                               | ...   |
| Cargen [Dumfries].....              | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 64·0         | 2     | 26·0 | 18     | 6                               | ...   |
| Lilliesleaf (Riddell House).....    | Roxburgh.....        | 55 31      | 2 46                 | 550                            | ...          | ...   | ...  | ...    | ...                             | ...   |
| Edinburgh (Royal Observatory).....  | Midlothian.....      | 55 55      | 3 11                 | 442                            | 61·8         | 2     | 28·4 | 18     | 1                               | 8     |
| Colmonell (Clachanton).....         | Ayr.....             | 55 8       | 4 54                 | 140                            | ...          | ...   | ...  | ...    | ...                             | ...   |
| Glasgow (Queen's Park).....         | Renfrew.....         | 55 53      | 4 18                 | 144                            | 64·0         | 2     | 30·0 | 17     | 2                               | 16    |
| Tighnabruach.....                   | Argyll.....          | 55 55      | 5 14                 | 50                             | 52·0         | 21    | 28·0 | 17     | 8                               | 8     |
| Mull (Quinish).....                 | ".....               | 56 36      | 6 13                 | 35                             | ...          | ...   | ...  | ...    | ...                             | ...   |
| Dundee (Eastern Necropolis).....    | Forfar.....          | 56 28      | 2 57                 | 199                            | 63·4         | 23    | 28·0 | 19     | 3                               | ...   |
| Braemar.....                        | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...   | ...  | ...    | ...                             | ...   |
| Aberdeen (Cranford).....            | ".....               | 57 8       | 2 7                  | 120                            | 58·0         | 1†    | 25·0 | 15, 18 | 10                              | ...   |
| Cawdor (Budgate).....               | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...   | ...  | ...    | ...                             | ...   |
| Invergarry.....                     | E. Inverness.....    | 57 4       | 4 47                 | 130?                           | ...          | ...   | ...  | ...    | ...                             | ...   |
| Loch Torridon (Bendamph).....       | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...   | ...  | ...    | ...                             | ...   |
| Dunrobin Castle.....                | Sutherland.....      | 57 59      | 3 56                 | 14                             | 58·5         | 23    | 33·5 | 17     | ...                             | ...   |
| Castletown.....                     | Caithness.....       | 58 35      | 3 23                 | 100                            | 58·0         | 1     | 29·0 | 18     | 7                               | 7     |
| Killarney (District Asylum).....    | Kerry.....           | 52 4       | 9 31                 | 178                            | 65·0         | 25    | 29·0 | 4      | ...                             | ...   |
| Waterford (Brook Lodge).....        | Waterford.....       | 52 15      | 7 7                  | 104                            | 63·5         | 24    | 29·0 | 4      | 4                               | ...   |
| Broadford (Hurdlestown).....        | Clare.....           | 52 48      | 8 38                 | 167                            | 65·0         | 24    | 28·0 | 3      | 5                               | ...   |
| Abbey Leix (Blandsfort).....        | Queen's County.....  | 52 56      | 7 17                 | 532                            | 63·0         | 23    | ...  | ...    | ...                             | 13    |
| Dublin (Fitz William Square).....   | Dublin.....          | 53 21      | 6 14                 | 54                             | 67·0         | 23    | 33·2 | 15     | 0                               | 6     |
| Ballinasloe.....                    | Galway.....          | 53 20      | 8 15                 | 160                            | 70·0         | 24    | 24·0 | 4, 18  | 12                              | ...   |
| Clifden (Kylemore House).....       | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...   | ...  | ...    | ...                             | ...   |
| Crossmolina (Ennisceoe).....        | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...   | ...  | ...    | ...                             | ...   |
| Seaford.....                        | Down.....            | 54 19      | 5 50                 | 180                            | 62·0         | 23    | 30·0 | 17     | 3                               | 6     |
| Londonderry (Creggan Res.).....     | Londonderry.....     | 54 59      | 7 19                 | 320                            | ...          | ...   | ...  | ...    | ...                             | ...   |
| Omagh (Edenfel).....                | Tyrone.....          | 54 36      | 7 18                 | 280                            | 57·0         | 1, 23 | 29·0 | 17     | ...                             | ...   |

† and 21, 22,

† and 19, 20, 27, 28.

## RAINFALL FOR APRIL, 1907.

| RAINFALL OF MONTH. |       |                    |          |                   |             |     | RAINFALL FROM JAN. 1. |       |                      |          | Mean Annual 1870-1899. | STATION.           |
|--------------------|-------|--------------------|----------|-------------------|-------------|-----|-----------------------|-------|----------------------|----------|------------------------|--------------------|
| ver. 0-99.         | 1907. | Diff. from Av. in. | % of Av. | Max. in 24 hours. | No. of Days |     | Aver. 1870-99.        | 1907. | Diff. from Aver. in. | % of Av. |                        |                    |
| n.                 | in.   |                    |          | in.               | Date.       |     | in.                   | in.   |                      |          | in.                    |                    |
| 69                 | 3.22  | +1.53              | 191      | .49               | 6           | 18  | 6.82                  | 6.27  | — .55                | 92       | 25.16                  | Camden Square      |
| 77                 | 3.16  | +1.39              | 179      | .51               | 26          | 18  | 7.87                  | 6.46  | — 1.41               | 82       | 28.36                  | Tenterden          |
| 99                 | 4.38  | +2.39              | 220      | .57               | 29          | 22  | 8.73                  | 7.37  | — 1.36               | 84       | 29.93                  | West Dean          |
| 69                 | 4.42  | +2.73              | 262      | .54               | 12          | 19  | 7.91                  | 7.58  | — .33                | 96       | 27.10                  | Hartley Wintney    |
| 62                 | 2.62  | +1.00              | 162      | .55               | 30          | 15  | 6.50                  | 5.78  | — .72                | 89       | 24.66                  | Hitchin            |
| 83                 | 2.66  | + .83              | 145      | .51               | 30          | 19  | 7.23                  | 5.87  | — 1.36               | 81       | 26.75                  | Addington          |
| 54                 | 2.85  | +1.31              | 185      | .68               | 30          | 19  | 6.43                  | 6.69  | + .26                | 104      | 25.39                  | Westley            |
| 68                 | 3.21  | +1.53              | 191      | .67               | 30          | 23  | 6.49                  | 8.09  | + 1.60               | 125      | 25.40                  | Brundall           |
| 60                 | 4.89  | +2.29              | 188      | 1.19              | 20          | 19  | 12.02                 | 9.78  | — 2.24               | 81       | 39.00                  | Winterbourne Stptn |
| 45                 | 4.15  | +1.70              | 170      | .63               | 13          | 19  | 10.96                 | 8.07  | — 2.89               | 74       | 35.00                  | Torquay            |
| 23                 | 4.37  | +2.14              | 196      | .87               | 2           | 22  | 11.35                 | 10.22 | — 1.13               | 90       | 38.85                  | Polapit Tamar      |
| 05                 | 3.57  | +1.52              | 174      | .67               | 12          | 18  | 8.63                  | 6.76  | — 1.87               | 78       | 30.75                  | Bath               |
| 05                 | 3.50  | +1.45              | 171      | .58               | 12          | 19  | 8.50                  | 6.85  | — 1.65               | 81       | 29.85                  | Stroud             |
| 14                 | 2.93  | + .79              | 137      | .98               | 12          | 15  | 9.23                  | 7.68  | — 1.55               | 83       | 33.04                  | Woolstaston        |
| 66                 | 2.02  | + .36              | 122      | .54               | 12          | 14  | 6.56                  | 4.12  | — 2.44               | 63       | 24.50                  | Bromsgrove         |
| 59                 | 1.63  | + .04              | 103      | .30               | 4           | 16  | 6.09                  | 5.01  | — 1.08               | 82       | 23.30                  | Boston             |
| 69                 | 1.70  | + .01              | 101      | .37               | 13, 21      | 15  | 6.56                  | 5.30  | — 1.26               | 81       | 24.70                  | Hodsock Priory     |
| 72                 | 1.73  | + .01              | 101      | .23               | 13          | 23  | 6.82                  | 6.02  | — .80                | 88       | 26.18                  | Derby              |
| 15                 | 1.87  | — .28              | 87       | .56               | 6           | 18  | 11.08                 | 10.52 | — .56                | 95       | 42.43                  | Bolton             |
| 98                 | 1.52  | — .46              | 77       | .28               | 2           | 15  | 7.35                  | 6.33  | — 1.02               | 86       | 26.96                  | Ribston Hall       |
| 32                 | 3.64  | + .32              | 110      | 1.12              | 22          | 17  | 19.42                 | 19.93 | + .51                | 103      | 60.96                  | Arncliffe Vic.     |
| 72                 | 1.59  | — .13              | 92       | .32               | 30          | 16  | 7.17                  | 5.37  | — 1.80               | 75       | 27.02                  | Hull               |
| 79                 | 2.53  | + .74              | 141      | .60               | 3           | 20  | 7.43                  | 5.39  | — 2.04               | 73       | 27.99                  | Newcastle          |
| 27                 | 7.16  | + .89              | 114      | 1.91              | 20          | 14  | 43.13                 | 35.96 | — 7.17               | 83       | 132.68                 | Seathwaite         |
| 34                 | 3.78  | +1.44              | 161      | .80               | 12          | 22  | 12.11                 | 10.06 | — 2.05               | 83       | 42.81                  | Cardiff            |
| 67                 | 4.36  | +1.69              | 163      | .85               | 20          | 19  | 14.53                 | 10.47 | — 4.06               | 72       | 47.88                  | Haverfordwest      |
| 39                 | 2.54  | + .15              | 106      | .43               | 3           | 14  | 12.22                 | 11.06 | — 1.16               | 91       | 45.41                  | Gogerddan          |
| 82                 | 1.12  | — .70              | 62       | .16               | 3           | 15  | 8.33                  | 6.02  | — 2.31               | 72       | 30.98                  | Llandudno          |
| 30                 | 2.87  | + .57              | 125      | .79               | 6           | 10  | 13.47                 | 12.19 | — 1.28               | 90       | 43.43                  | Cargen             |
| 96                 | ...   | ...                | ...      | ...               | ...         | ... | 9.37                  | ...   | ...                  | ...      | 33.04                  | Riddell House      |
| ...                | 1.31  | ...                | ...      | .36               | 30          | 15  | ...                   | 4.99  | ...                  | ...      | ...                    | Edinburgh          |
| 25                 | ...   | ...                | ...      | ...               | ...         | ... | 13.62                 | ...   | ...                  | ...      | 44.85                  | Colmonell          |
| 77                 | 2.38  | + .61              | 135      | .55               | 6, 10       | 13  | 9.88                  | 10.86 | + .98                | 110      | 35.80                  | Glasgow            |
| 89                 | 2.61  | — .28              | 90       | .55               | 6           | 12  | 17.68                 | 18.07 | + .39                | 102      | 57.90                  | Tighnabruaich      |
| 80                 | 3.54  | + .74              | 126      | .59               | 3           | 20  | 17.38                 | 17.71 | + .33                | 102      | 57.53                  | Quinish            |
| 94                 | 1.85  | — .09              | 95       | .45               | 3           | 15  | 8.06                  | 5.60  | — 2.46               | 69       | 28.95                  | Dundee             |
| 18                 | 3.69  | +1.51              | 169      | ...               | ...         | ... | 10.21                 | 9.38  | — .83                | 92       | 36.07                  | Braemar            |
| 22                 | 1.59  | — .63              | 72       | .28               | 30          | 17  | 9.40                  | 6.88  | — 2.52               | 73       | 33.01                  | Aberdeen           |
| 49                 | 1.73  | + .24              | 116      | .52               | 30          | 10  | 7.65                  | 7.66  | + .01                | 100      | 29.37                  | Cawdor             |
| 68                 | 3.17  | + .49              | 118      | .95               | 6           | 7   | 19.03                 | 22.69 | + 3.66               | 119      | 56.00                  | Invergarry         |
| 31                 | 5.45  | +1.14              | 127      | .75               | 30          | 17  | 26.21                 | 36.33 | +10.12               | 139      | 86.50                  | Bendarnagh         |
| 81                 | 2.20  | + .39              | 122      | .37               | 15          | 15  | 9.29                  | 11.47 | + 2.18               | 123      | 31.60                  | Dunrobin Castle    |
| ...                | 2.18  | ...                | ...      | .40               | 26          | 22  | ...                   | 11.58 | ...                  | ...      | ...                    | Castletown         |
| 71                 | 3.90  | + .19              | 105      | .58               | 7           | 25  | 19.75                 | 11.73 | — 8.02               | 59       | 58.11                  | Killarney          |
| 56                 | 3.60  | +1.04              | 141      | .56               | 6           | 21  | 12.47                 | 7.35  | — 5.12               | 59       | 39.30                  | Waterford          |
| 17                 | 3.40  | +1.23              | 157      | .67               | 5           | 19  | 9.51                  | 9.79  | + .28                | 103      | 33.47                  | Hurdlestown        |
| 40                 | 3.38  | + .98              | 141      | 1.02              | 8           | 23  | 10.50                 | 8.53  | — 1.97               | 81       | 35.19                  | Abbey Leix         |
| 00                 | 2.62  | + .62              | 131      | .38               | 2           | 22  | 7.99                  | 6.28  | — 1.71               | 79       | 27.75                  | Dublin             |
| 32                 | 2.31  | — .01              | 100      | .65               | 8           | 20  | 10.74                 | 9.84  | — .90                | 92       | 37.04                  | Ballinasloe        |
| 74                 | 6.26  | +1.62              | 132      | 1.37              | 7           | 18  | 24.35                 | 20.01 | — 4.34               | 82       | 80.23                  | Kylemore House     |
| 90                 | 3.39  | + .49              | 117      | .52               | 5, 30       | 22  | 15.86                 | 15.46 | — .40                | 97       | 50.50                  | Enniscose          |
| 59                 | 2.81  | + .22              | 108      | .91               | 4           | 17  | 11.75                 | 9.26  | — 2.49               | 79       | 38.61                  | Seaford            |
| ...                | 2.76  | + .44              | 109      | .87               | 08          | 09  | ...                   | 16.58 | ...                  | ...      | ...                    | Seaford            |

## SUPPLEMENTARY RAINFALL, APRIL, 1907.

| Div.  | STATION.                          | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | 5.19            | XI.    | Rhayader, Tyrmynydd .....         | ...             |
| "     | Ramegate, West Cliff Villas ..... | 2.32            | "      | Lake Vyrnwy .....                 | 3.13            |
| "     | Hailsham .....                    | 3.76            | "      | Llangyhanaf, Plâs Draw .....      | 2.19            |
| "     | Crowborough, Uckfield Lodge ..... | 3.99            | "      | Criccieth, Talarvor .....         | 2.07            |
| "     | Osborne, Newbarn Cottage. ....    | ...             | "      | Llanberis, Pen-y-pass .....       | ...             |
| "     | Emsworth, Redlands .....          | 4.23            | "      | Lligwy .....                      | 1.44            |
| "     | Alton, Ashdell .....              | 4.62            | "      | Douglas, Woodville .....          | 2.71            |
| "     | Newbury, Welford Park .....       | 2.79            | XII.   | Stoneykirk, Ardwell House .....   | 2.55            |
| III.  | Harrow Weald, Hill House. ....    | 3.57            | "      | Dalry, The Old Garroch .....      | 4.08            |
| "     | Oxford, Magdalen College.. ..     | 1.87            | "      | Langholm, Drove Road .....        | 2.84            |
| "     | Bloxham Grove .....               | 2.33            | "      | Moniaive, Maxwellton House .....  | 2.67            |
| "     | Pitsford, Sedgebrook .....        | 2.26            | XIII.  | N. Esk Reservoir [Penicuik] ..... | 2.25            |
| "     | Huntingdon, Brampton .....        | 3.05            | XIV.   | Maybole, Knockdon Farm.. ..       | 3.27            |
| "     | Wisbech, Bank House .....         | 2.47            | XV.    | Campbeltown, Witchburn .....      | 2.81            |
| IV.   | Southend Water Works .....        | 2.23            | "      | Inveraray, Newtown .....          | 4.87            |
| "     | Colchester, Lexden .....          | 3.12            | "      | Ballachulish House .....          | 4.39            |
| "     | Newport, The Vicarage .....       | 3.23            | "      | Islay, Eallabus .....             | 3.54            |
| "     | Rendlesham .....                  | 3.10            | XVI.   | Dollar Academy .....              | 1.60            |
| "     | Swaffham .....                    | 3.03            | "      | Loch Leven Sluice .....           | 1.51            |
| "     | Blakeney .....                    | 2.82            | "      | Balquhiddy, Stronvar .....        | 4.30            |
| V.    | Bishops Cannings .....            | 4.13            | "      | Perth, Pitcullen House .....      | 1.66            |
| "     | Ashburton, Druid House .....      | 6.36            | "      | Coupar Angus Station .....        | 1.96            |
| "     | Okehampton, Oaklands .....        | 5.88            | "      | Blair Atholl .....                | 3.31            |
| "     | Hartland Abbey .....              | 5.42            | "      | Montrose, Sunnyside Asylum .....  | 1.57            |
| "     | Lynmouth, Rock House .....        | 4.43            | XVII.  | Alford, Lynturk Manse .....       | 2.33            |
| "     | Probus, Lamellyn .....            | 4.91            | "      | Keith Station .....               | 2.21            |
| "     | Wellington, The Avenue .....      | 4.93            | XVIII. | N. Uist, Lochmaddy .....          | 1.54            |
| "     | North Cadbury Rectory .....       | 4.52            | "      | Alvey Manse .....                 | 1.67            |
| VI.   | Clifton, Pembroke Road .....      | 3.95            | "      | Loch Ness, Drumnadrochit. ....    | 1.51            |
| "     | Ross, The Graig .....             | 3.11            | "      | Glencarron Lodge .....            | 4.70            |
| "     | Shifnal, Hatton Grange .....      | 2.11            | "      | Fearn, Lower Pitkerrie .....      | .90             |
| "     | Cheadle, The Heath House. ....    | 1.39            | XIX.   | Invershin .....                   | 2.20            |
| "     | Blockley, Upton Wold .....        | 3.01            | "      | Altnaharra .....                  | 2.33            |
| "     | Coventry, Kingswood .....         | 1.81            | "      | Bettyhill .....                   | 2.03            |
| VII.  | Market Overton .....              | 2.68            | XX.    | Dunmanway, The Rectory.. ..       | 4.55            |
| "     | Market Rasen .....                | 1.76            | "      | Cork .....                        | 2.99            |
| "     | Bawtry, Hesley Hall .....         | 1.76            | "      | Darrynane Abbey .....             | 4.31            |
| VIII. | Neston, Hinderton Lodge .....     | 1.01            | "      | Glenam [Clonmel] .....            | 3.48            |
| "     | Southport, Heslith Park .....     | 1.60            | "      | Ballingarry, Gurteen .....        | 2.01            |
| "     | Chatburn, Middlewood .....        | 1.69            | "      | Milton Malbay .....               | 2.89            |
| "     | Cartmel, Flookburgh .....         | 2.17            | XXI.   | Gorey, Courtown House .....       | 2.39            |
| IX.   | Langsett Moor, Up. Midhope .....  | 2.82            | "      | Moynalty, Westland .....          | 2.49            |
| "     | Scarborough, Scalby .....         | 2.02            | "      | Athlone, Twyford .....            | 2.71            |
| "     | Ingleby Greenhow .....            | 3.19            | "      | Mullingar, Belvedere .....        | 2.01            |
| "     | Mickleton .....                   | 1.25            | XXII.  | Woodlawn .....                    | 2.58            |
| X.    | Bardon Mill, Beltingham .....     | 2.29            | "      | Westport, Murriak Abbey.. ..      | ...             |
| "     | Ewesley, Fallowlees .....         | 3.44            | "      | Collooney, Markree Obay.. ..      | 3.12            |
| "     | Ilderton, Lilburn Cottage .....   | 3.09            | "      | Mohill .....                      | 2.23            |
| "     | Keswick, York Bank .....          | 2.65            | XXIII. | Enniskillen, Portora .....        | 2.13            |
| XI.   | Llanfrehfa Grange .....           | 3.57            | "      | Warrenpoint, Summer Hill. ....    | 2.31            |
| "     | Treherbert, Tyn-y-waun .....      | 5.97            | "      | Banbridge, Milltown .....         | 2.62            |
| "     | Cardarthen, The Friary .....      | 3.87            | "      | Belfast, Springfield .....        | 2.34            |
| "     | Castle Malgwyn [Llechryd] .....   | 4.00            | "      | Bushmills, Dundarave .....        | 2.06            |
| "     | Plynlimon .....                   | 5.70            | "      | Stewartstown, The Square.. ..     | 2.28            |
| "     | Tall-y-llyn .....                 | ...             | "      | Killybegs .....                   | 3.95            |
| "     | New Radnor, Ednol .....           | 2.89            | "      | Horn Head .....                   | 2.49            |

## METEOROLOGICAL NOTES ON APRIL, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—The brilliant weather of Easter gave way on 3rd to unsettled conditions, which lasted throughout the month, with copious R at frequent intervals. After 2nd the shade temp. reached 60° on three days only, but there were few frosts. Mean temp. 47°·3, or 0°·8 below the average. Duration of sunshine 104·2\* hours, and of R 65·6 hours.

CROWBOROUGH.—Cold and wet, with occasional night frosts. R 1·84 in. above the average of 36 years, reducing the deficiency for the year to ·99 in. Mean temp. 46°. On 7th an inch and a half of S fell.

HARTLEY WINTNEY.—Very cold and wet, being the wettest April yet recorded here. In the second week the weather was stormy and unsettled, with slight TSS daily, and during the last week there was a bitter wind, which greatly retarded vegetation. Ozone was recorded daily, with a mean of 5·2.

TORQUAY.—Duration of sunshine 182·3\* hours, or 1·7 hours above the average. Mean temp. 47°·7, or 0°·5 below the average. Mean amount of ozone 5·2.

NORTH CADBURY.—By far the wettest April in 11 years, the R being nearly double that of the previous three months. The mean max. temp. was very low, but the min. and number of frosts normal. The heaviest S of the winter. about three inches fell early on 7th.

BOLTON.—The pressure and mean temp. were close to the normal, the latter being 44°·2, or 0°·3 below the average, but the duration of sunshine, 70·4\* hours, was remarkably low, 38·5 hours below the average, and the least in April since 1891. The weather throughout was dull and changeable.

SOUTHPORT.—The mean bar. was very low during the first half, but it was otherwise a normal month. Easterly winds generally till the 19th. Mean temp. 45°·7, or 0°·2 below the average. Duration of sunshine 163\* hours, or 16 hours below the average. Duration of rainfall 38·3 hours.

HAVERFORDWEST.—A cold month, with large R, which fell mostly at night, Duration of sunshine 156·7\* hours. Vegetation backward.

DOUGLAS.—Stormy, with more or less strong polar winds throughout, so that the backward vegetation made little progress in a generally ungenial month. S fell heavily for some hours on 6th.

DUMFRIES.—A cold bleak month, but without low. min. temp. Cold W. winds at the close, accompanied by blizzard like showers, occasioned a serious check on vegetation.

COUPAR ANGUS.—Bleak throughout, with cold N.W. winds. The R was normal, but the mean temp. 43°·0 was 1°·0 below the average.

DEUMNADROCHIT.—R 35 in., and rain days 2, below the average of 21 years. On the whole it was sunny but with frequent cold winds, and on high land a good deal of S.

DUNMANWAY.—On the whole cold, with heavy showers and sometimes H, but bright sunshine was frequent.

DARRYNANE ABBEY.—Wet and changeable, with some fine warm days, but the last few days were very cold. R 21 per cent. above the average.

DUBLIN.—Cloudy, unsettled and rainy. Distinctly cold but for a warm spell between 22nd and 25th. Mean temp. 47°·2, or 0°·4 below the average. H on 4 days.

OMAGH.—Cold, wet and unsettled, with S on 26th and heavy H showers on 29th. Corn-crakes and swallows were seen on 30th.

\* Campbell-Stokes.

## Climatological Table for the British Empire, November, 1906.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain |       | Aver. |        |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|------------|-------|-------|--------|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Max. on<br>Grass. | Depth.     | Days. |       | Cloud. |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |      |               |           |                 |                   |            |       |       |        |
| London, Camden Square                                            | 60·1      | 22    | 28·7     | 19    | 51·9     | 41·6 | 43·9          | 90        | 80·2            | 28·0              | inches     | 4·20  | 17    | ...    |
| Malta ... ..                                                     | ...       | ...   | ...      | ...   | ...      | ...  | ...           | ...       | ...             | ...               | ...        | ...   | ...   | ...    |
| Lagos ... ..                                                     | 89·0      | 7a    | 72·0     | 26    | 86·6     | 75·6 | 74·7          | 76        | 160·0           | 70·0              | 1·37       | 9     | 5·7   | ...    |
| Cape Town ... ..                                                 | 86·5      | 1     | 50·4     | 17    | 74·3     | 57·4 | 52·3          | 63        | ...             | ...               | ·53        | 5     | 3·7   | ...    |
| Durban, Natal ... ..                                             | 86·3      | 7     | 55·1     | 19    | 78·2     | 64·1 | ...           | ...       | 146·5           | ...               | 3·19       | 19    | 5·8   | ...    |
| Johannesburg ... ..                                              | 82·1      | 2     | 42·9     | 16    | 70·9     | 51·5 | 50·1          | 70        | 160·3           | 41·5              | 5·34       | 12    | 4·7   | ...    |
| Mauritius ... ..                                                 | 88·1      | 30    | 61·0     | 7     | 82·4     | 65·1 | 61·6          | 67        | 148·1           | 54·4              | ·62        | 11    | 5·7   | ...    |
| Calcutta... ..                                                   | 86·4      | 3     | 59·5     | 26    | 82·7     | 65·4 | 64·8          | 74        | 148·8           | 54·0              | ·35        | 2     | 1·9   | ...    |
| Bombay... ..                                                     | 91·8      | 23    | 72·1     | 30    | 89·4     | 75·7 | 69·9          | 68        | 136·5           | 60·9              | ·00        | 0     | 1·4   | ...    |
| Madras ... ..                                                    | 90·9      | 6     | 68·7     | 27    | 85·7     | 72·5 | 71·9          | 83        | 143·5           | 65·6              | 6·47       | 15    | 5·9   | ...    |
| Kodaikanal ... ..                                                | 85·5      | 17    | 45·8     | 22    | 60·8     | 49·5 | 50·5          | 88        | 126·8           | 37·2              | 10·93      | 20    | 7·4   | ...    |
| Colombo, Ceylon ... ..                                           | 88·4      | 23    | 71·8     | 6     | 85·3     | 73·9 | 72·6          | 85        | 152·8           | 68·0              | 14·85      | 19    | 6·9   | ...    |
| Hongkong ... ..                                                  | 82·9      | 2     | 55·3     | 20    | 73·4     | 62·4 | 54·0          | 62        | 137·5           | ...               | ·18        | 4     | 4·9   | ...    |
| Melbourne ... ..                                                 | 87·3      | 17    | 40·6     | 5     | 67·0     | 49·5 | 47·7          | 72        | 148·2           | 36·2              | 2·47       | 13    | 7·8   | ...    |
| Adelaide ... ..                                                  | 90·4      | 8     | 44·3     | 6     | 73·2     | 52·8 | 48·2          | 57        | 148·0           | 41·1              | 2·45       | 11    | 6·4   | ...    |
| Coolgardie ... ..                                                | 98·0      | 24    | 42·9     | 18    | 79·7     | 53·1 | 45·4          | 47        | 166·9           | 39·2              | ·99        | 6     | 3·4   | ...    |
| Sydney ... ..                                                    | 92·0      | 22    | 48·2     | 6     | 73·8     | 57·5 | 51·4          | 61        | 133·2           | 36·0              | 4·12       | 19    | 4·8   | ...    |
| Wellington ... ..                                                | 67·5      | 23    | 41·0     | 16    | 61·4     | 48·9 | 47·2          | 73        | 143·0           | 34·0              | 4·69       | 14    | 6·2   | ...    |
| Auckland ... ..                                                  | 72·0      | 25    | 49·0     | 10    | 66·0     | 53·7 | 51·3          | 73        | 139·0           | 42·0              | 5·62       | 12    | 5·2   | ...    |
| Jamaica, Negril Point.                                           | 89·1      | 16    | 68·0     | 26    | 85·7     | 72·8 | 72·3          | 84        | ...             | ...               | 2·77       | 6     | ...   | ...    |
| Trinidad ... ..                                                  | 90·0      | sevl  | 78·0     | 9     | 87·6     | 71·1 | 73·5          | 83        | 162·0           | 66·0              | 5·00       | 12    | ...   | ...    |
| Grenada ... ..                                                   | 88·0      | 4, 5  | 72·0     | 25b   | 81·4     | 74·7 | 72·3          | 78        | 152·0           | ...               | 9·89       | 23    | 4·3   | ...    |
| Toronto ... ..                                                   | 53·6      | 18    | 21·6     | 14    | ...      | ...  | 31·4          | 79        | ...             | ...               | 1·68       | 13    | 7·0   | ...    |
| Winnipeg ... ..                                                  | 47·3      | 7     | -10·0    | 20    | ...      | ...  | ...           | ...       | ...             | ...               | 1·67       | 12    | 7·0   | ...    |
| St. John's, N.B. ... ..                                          | 54·6      | 19    | 15·3     | 30    | ...      | ...  | ...           | ...       | ...             | ...               | 5·21       | 14    | 7·0   | ...    |
| Victoria, B.C. ... ..                                            | 56·1      | 9     | 30·4     | 29    | ...      | ...  | ...           | ...       | ...             | ...               | 6·13       | 16    | 7·0   | ...    |
| Dawson ... ..                                                    | 22·0      | 1     | -41·0    | 30    | ...      | ...  | ...           | ...       | ...             | ...               | 1·55       | 8     | 6·0   | ...    |

a and 22, 23. b and 27, 30.

Johannesburg.—Rainfall above the average.

Mauritius.—Mean temp. of air 78°·0, dew point 2°·7, relative humidity 1·3 per cent., and E 1·18 in. below averages. Mean hourly velocity of wind 8·7 miles, or 2·0 below average.

MADRAS.—TS on one day, distant T on 3 days and L on one other day. Bright sunshine 131·1 hours.

KODAIKANAL.—Bright sunshine 110 hours.

COLOMBO.—Mean temp. of air 78°·7, or 1°·2 below, of dew point 0°·3 above, and E 2·41 in. above averages. Mean hourly velocity of wind 6·6 miles.

HONGKONG.—Mean temp. of air 67°·4. Bright sunshine 204·4 hours. E 1·53 in. below averages. Mean hourly velocity of wind 10·8 miles.

Adelaide.—Mean temp. of air 4°·1 below average, and coldest on record in 49 years. E heaviest on record for 49 years, except 1903.

Sydney.—Mean temp. of air 1°·2 below, and E 1·05 in. above, averages.

Wellington.—E 1·13 in. above the average.

Auckland.—Mean temp. slightly above, and E 2·00 in. above averages.

TRINIDAD.—E 1·98 in. below 43 years' average.

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## Wilhelm von Bezold.

MUNICH, 1837—BERLIN, 1907.

PROFESSOR VON BEZOLD, the eminent Director of the Prussian Meteorological Institute, died in his seventieth year, at Charlottenburg, after a long illness, on February 17th. He was born at Munich, and after graduating at Göttingen in 1860, returned to his native city, where he was engaged for many years as lecturer and professor of theoretical physics at the University. His first important investigation was on twilight phenomena, undertaken in consequence of the interest aroused by the far-famed afterglows visible in the Alps, and this was published in 1864. A few years later his attention was directed to the peculiarities of thunderstorms and he commenced an elaborate study, based largely on the statistics of insurance companies, of the frequency and periodicity of the phenomena. In 1878 he was appointed to reorganize and direct the meteorological service of Bavaria and remained in this office until 1885. In that year he was called to Berlin, on the death of Professor Dove, to undertake similar duties for the Prussian Meteorological Service, for it may be news to some of our readers to learn that there is no uniform imperial meteorological organization in Germany. In Berlin Dr. von Bezold filled the double position of Professor of Meteorology in the University and Director of the Prussian Meteorological Institute.

He continued his researches on the frequency of thunderstorms for a time, and gradually devoted himself more and more exclusively to the detailed discussion of the thermodynamics of the atmosphere and to terrestrial magnetism. While his later writings appeal mainly to the mathematical student, and have led to the opinion that the work of von Bezold lay rather in the advancement than in the spread of meteorological science, he was also the author of many papers of a more popular character, not a few of these being preliminary sketches which he afterwards elaborated in his classic memoirs. In his work at Berlin the late Director had the advantage of the co-operation of gifted colleagues, amongst whom Professor Hellmann, who had charge of the great rainfall system of Prussia, Professor Assmann, who had charge of the aeronautical observatory (now an independent institution), Professor Sprung of the instrumental department in Potsdam, and Professor A. Schmidt of the the magnetic observatory, may be mentioned.

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## RADIATION PHENOMENA IN SOUTH AFRICA.

MR. JAMES LYLE, of Grey College, Bloemfontein, who has charge of the Meteorological Service of the Orange River Colony, forwards for publication the two following letters, which were addressed to him by observers in the Colony, and we print them with great pleasure, recognising the growth of interest in the science of the weather which is taking place amongst the people as well as amongst the governments of South Africa.

During the last few years I have often observed heavy storm-clouds breaking over the Mabula mountains, about eight miles east from here, and wish to make known to you an unusual sight I saw this afternoon about 3 p.m. Heavy dark clouds were massed above these hills, with a gentle east wind blowing, when I observed what appeared like a jet descending from the clouds; shortly after, another appeared, and within five minutes the ends disappeared behind the hills like two gigantic kite tails and soon became obscured by heavy rain which began to fall.

I am sending you a rough sketch of the cloud and jets. Could you give me any information as to what it likely was?

A heavy shower of hail appeared to have fallen on Mr. Wright's farm in the Lady Brand District, over which the storm had taken its course. Two hours after the storm the hail on the veldt, although ten miles distant, had the appearance of a lake. Considerable damage must have been done to the growing crops and fruit trees.

*Lions Rump, 12th November, 1906.*

W. F. GEBHARDT.

Lions Rump is situated in the Mabula mountains on the border of Basuto Land, and Mr. Lyle points out that 3 p.m. is the usual hour for thunderstorms and radiation phenomena generally. The sketches, which we are sorry we cannot reproduce, present very much the appearance of a tornado cloud, the "tails" being more slender and more inclined to the horizon than the waterspouts represented in Captain Page's article on p. 47 of our April number.

I thought perhaps you might like to have further particulars of the terrific hailstorm that passed over this district last Wednesday, December 19th.

I was away from this farm on that afternoon and only saw the storm in the distance, so cannot tell exactly how long it lasted, though I believe it was under half-an-hour.

The storm came from the N.W., and has devastated all the farms from Ficksburg to Brindisi, and apparently its track varied in width from  $1\frac{1}{2}$  to 3 miles. The hailstones are said to have been as large as hen's eggs, and all cultivated lands on this farm are pitted thickly with marks of this size. The corrugated iron roof on the stable here is deeply indented, and the rain gauge you sent me looks as if it had been knocked about with a hammer.

I am glad to say we lost no stock, though a neighbour this morning informed me he had a horse, a calf and five sheep killed by the hail, and his neighbour had also lost several sheep.

H. C. B. SPARROW.

*Krauskloof, Ficksburg, O.R.C., December 21st, 1906.*

Mr. Lyle points out that the hours, the direction and the breadth of the hailstorm are all quite usual. He has seen marks of hailstones on the land last for weeks, and cases are known of corrugated iron being perforated by angular hail. The rain gauge referred to was a copper instrument of the Meteorological Office pattern.

We may mention that exact observations of phenomena such as those described above are of real value, and we would urge on observers the importance of having a pocket camera within reach and photographing the effects described before they disappear. In the case of hail it is particularly important that some coins, or a footrule or other object of known size, should be placed amongst the hailstones so as to leave no doubt possible as to the size.

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## THE NEW PREMISES FOR THE METEOROLOGICAL OFFICE.

WE referred in our number for October, 1906, (Vol. 41, p. 165) to the proposed removal of the Meteorological Office from Victoria Street to South Kensington, and we now find some particulars of the new site in an article published in the *Morning Post* of May 21st, from which we extract the following :—

On referring to the Civil Service Estimates submitted to Parliament this session there is found under Sub-head A—New Works, Alterations, Additions, and Purchases—the item “Meteorological Office—Erection of Offices at South Kensington.” The original estimate of the cost of the new office is given at £10,580, but of this sum the vote required for the current financial year is only £500, leaving £10,080 to be voted in subsequent years.

When it is stated that the spot selected for the future home of the Weather Department forms the south corner at the junction of Exhibition Road and Imperial Institute Road, surrounded by such magnificent piles of buildings as the Natural History Museum, the Victoria and Albert Museum, the Imperial Institute, &c., it is pretty obvious that £10,000 will go a very little way, indeed, towards providing an edifice at all comparable with its great neighbours. It is, therefore, a relief to learn on enquiry that the sum allotted by the Treasury for accommodating the Meteorological Office forms only a small portion of the cost of a large building which it has been decided to erect. . . . Plans have been prepared for the erection of a block of buildings on the spot mentioned above, the greater part to be occupied as the District Post and Telegraph Office for South Kensington, and the upper portion to be the National Meteorological Office provided with ample space for the staff and for visitors, and also with a separate library accommodation and convenient arrangements for the proper display of charts and diagrams. To the general reader the association of the two public services, the Post and the Weather, may not at first sight be obvious, but it is, for all that, a very real one. The telegrams to and from the Meteorological Office involve an expenditure of little short of £2,000 per annum, and as promptness is

essential in the receipt and despatch of reports, storm warnings, &c., it has thus far been necessary to provide private wires and instruments and a staff of telegraph clerks, so that the total cost of the telegraphic work of the establishment forms a very large proportion of the Parliamentary grant of £15,300 a year, for the Postmaster-General insists upon charging for providing private wires and instruments on the same scale as for the general public. With the transfer of the office to South Kensington the whole of this extra expense will be saved, the telegraphic work being performed by the Post Office staff in a neighbouring room. The public will very naturally suppose that there will also be a saving in the rent of the premises, that in a Government building a national department would be provided with quarters free of cost. But this is not so. The Treasury Authorities are too wide-awake to be caught napping on this point. Sir George Murray was instructed to state that "My Lords are favourably disposed to the proposal that premises shall be constructed for the Meteorological Office in a block of buildings to be erected at South Kensington to contain a post-office; and my Lords, on present information, believe that the rent payable by the Committee of such a building would not exceed by any considerable sum the amount expended by the Committee on the rent of their present premises." The Victoria Street rental is, it appears, £635 per annum, so that it looks as if my Lords mean to charge about 7 per cent., perhaps more, per annum on the estimated cost of new premises.

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## ROYAL METEOROLOGICAL SOCIETY.

THE first of the afternoon meetings for the present session was held on Wednesday, May 15th, at the Society's rooms, 70, Victoria Street, Westminster; Dr. H. R. Mill, President, in the chair.

In opening the meeting the President paid a tribute to the life and work of Dr. A. Buchan, F.R.S., the first recipient of the Society's Symons' Gold Medal, whose death had just been announced.

Dr. H. R. Mill read a paper on "The Standard Rain Gauge, with Notes on other Forms." When the late Mr. Symons founded the British Rainfall Organization, forty-seven years ago, such observations as were being carried on were made with rain gauges of the most varied patterns, set up at any height from the ground that suggested itself to the observer, and read irregularly at almost any hour of the day or night. Since that time there has been a steady approximation to uniformity, and now the greater number of rain gauges in use are of a few definite patterns, set for the most part at nearly the same height above the ground. Dr. Mill strongly recommends the Snowdon pattern of rain gauge, which is 5 inches in diameter, has a vertical rim to the funnel of 4 inches, and has an inner can and also a bottle. The larger Meteorological Office pattern of similar shape but 8 inches in diameter is equally accurate but unnecessarily large. He does not recommend rain gauges with shallow funnels, nor the Glaisher pattern, the latter being par-

ticularly liable to give readings that are much too high when it begins to go out of repair.

Mr. J. W. Lovibond read a paper "On a Method and Apparatus for measuring Fog Densities." The method is based on the power of selective absorption of suitably coloured glass. When this has been graded into mechanical scales of equivalent colour value, a beam of white light can be progressively absorbed to extinction and the luminous value of each successive absorption stated in quantitative terms. This analytical power also applies to the colour constituents of the beam.

Colonel J. E. Capper, R.E., C.B., gave an account of a captive balloon being struck by lightning at Farnborough during a thunderstorm on April 11th. The lightning flash appeared to travel along the wire until it reached the wagon; then a sudden bright light appeared and ran right up the wire into the clouds by which the balloon was hidden. The wire was fused, and burnt entirely away where it first touched the iron pulleys which guide the wire when running out. One side of the balloon and net was burnt, probably owing to the hydrogen catching fire.

Professor A. Herschel gave an account of a remarkable excavation made by lightning in peat earth on August 2nd or 3rd, 1906, in a moorland district of Northumberland. A large hole 4 or 5 feet in diameter was found on a flat part of the moor, radiating from which there were six or seven furrows, and pieces of turf were thrown in various directions. The largest turf, about 3 feet in diameter and 1 foot thick, was lying 26 yards away, and other pieces were lying around within 20 yards of the hole. On excavating the hole it was found that a number of small holes radiated to various depths.

The discussion on the various papers was joined in by the President, Mr. F. C. Bayard, Mr. E. Gold, Mr. W. Greathead, Mr. A. Hands, Professor A. Herschel, Mr. J. Hopkinson, Mr. R. Inwards, Mr. B. Latham, Mr. W. Marriott, and Mr. W. B. Tripp.

The following gentlemen were elected Fellows of the Society:—Mr. C. J. Davies, Rev. W. Esdaile, M.A., Shaikh Abul Fazl, M.A., LL.D., Mr. K. Nishizawa, Mr. R. Rhodes, and Mr. R. A. Ryves.

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

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### SNOW IN JUNE.

I THINK it will interest you to hear that snow fell in Farnham about 11.30 a.m. on the 3rd of this month. I did not see it myself, but I have it from a reliable witness.

GEO. CHRYSTIE.

*Short Heath Lodge, Farnham, Surrey, June 6th, 1907.*

## THE ENERGY OF STORMS.

THERE is a statement in your Magazine for May which should not pass without comment. The question whether the heat set free by the condensation of vapour is or is not sufficient to provide the energy of a cyclone, is one that can be settled by a direct and simple calculation, and does not depend on the opinion of the best or the worst thinkers. The principles involved and the numerical quantities required can be found in any good text-book on physics.

The heat set free by the condensation of one pound of vapour, under average conditions of temperature, will raise the temperature of 600 lbs. of water  $1^{\circ}$  C. Taking Joule's equivalent at 1390 for  $1^{\circ}$  C., this gives  $600 \times 1390$  ft. lbs. of energy for each pound condensed. Now, a rainfall of  $\cdot 01$  in. deposits  $\cdot 052$  lbs. on each square foot of surface, and hence provides  $600 \times 1390 \times \cdot 052 = 43,368$  ft. lbs. of energy for each square foot.

The mass of air resting on each sq. ft. is about  $15 \times 12 \times 12$  lbs., and hence the energy produced by the formation from vapour of  $\cdot 01$  in. of rain can raise the whole weight of air over the rainfall area  $\frac{43368}{12 \times 12 \times 15} = 20\cdot 8$  ft., or impart to it a velocity due to a fall of 20·8 ft., that is, using the formula  $V^2 = 2gs$ , a velocity of a little over 36 ft. per second, or 25 miles an hour.

For a rainfall of  $\cdot 04$  the corresponding velocity is 50 miles per hour, force 9 on the Beaufort scale.

Further, we may remember that the whole mass of air to its upper limit is not involved in a cyclone, and since a smaller mass is involved, the velocity will be greater. Also the rain need not fall, the energy is supplied by the change from vapour to cloud, and the equivalent of  $\cdot 04$  in. of rain may be contained in a cloud of 1,000 ft. thickness or less.

Since the cyclones of our latitudes seldom give less than  $\cdot 10$  in. of rain along their track, and the tropical hurricanes frequently give 10·0 in. or more, the latent heat of condensation certainly can provide a most ample supply of energy. It does not follow that cyclones are necessarily generated and maintained in this manner; they present at the present time an unsolved problem, and it is certain that in some circumstances heavy rains do not produce wind. On the other hand, cyclones certainly prefer localities where there is a copious supply of moisture, and, personally, I believe that the chief motive and sustaining power is the heat produced by the condensation of vapour.

W. H. DINES.

## WARM AND COLD SEASONS.

THE following classification of the last 65 years at Greenwich (reckoned as made up of Spring, Summer, Autumn and Winter, *i.e.*, March to February) may be of interest.

Call a season warm (W.) where two or three months are warm (*i.e.*, with mean temperature above the average); cold (C.) in the opposite case. Then we have:

|     | Spring. | Sum. | Autm. | Win. |                                           |   |
|-----|---------|------|-------|------|-------------------------------------------|---|
| 1.  | W.      | W.   | W.    | W.   | ... '47, '65, '72, '95, '01 .....         | 5 |
| 2.  | W.      | W.   | W.    | C.   | ... '46, '57 .....                        | 2 |
| 3.  | W.      | W.   | C.    | C.   | ... '59, '70, '78 .....                   | 3 |
| 4.  | W.      | C.   | C.    | C.   | ... '54, '64, '67, '80 .....              | 4 |
| 5.  | C.      | C.   | C.    | C.   | ... '53, '60, '79, '88, '89, '92 .....    | 6 |
| 6.  | C.      | C.   | C.    | W.   | ... '45, '50, '02 .....                   | 3 |
| 7.  | C.      | C.   | W.    | W.   | ... '66, '83, '98 .....                   | 3 |
| 8.  | C.      | W.   | W.    | W.   | ... '55, '58, '61, '76, '97, '00 .....    | 6 |
| 9.  | W.      | C.   | C.    | W.   | ... '41, '71, '81 .....                   | 3 |
| 10. | W.      | C.   | W.    | W.   | ... '43, '48, '62, '82 .....              | 4 |
| 11. | W.      | W.   | C.    | W.   | ... '42, '68, '84, '93, '96, '04, '05 ... | 7 |
| 12. | C.      | W.   | W.    | C.   | ... '86, '99 .....                        | 2 |
| 13. | C.      | W.   | C.    | C.   | ... '56, '75, '85, '87 .....              | 4 |
| 14. | C.      | C.   | W.    | C.   | ... '44, '69, '91 .....                   | 3 |
| 15. | C.      | W.   | C.    | W.   | ... '51, '52, '73, '77 .....              | 4 |
| 16. | W.      | C.   | W.    | C.   | ... '49, '63, '74, '90, '94, '03 .....    | 6 |

65

We find that years with a preponderance of warm seasons number 24; cold seasons, 20; two warm, two cold, 21.

I would invite comment on these facts.

ALEX. B. MacDOWALL.

### THE WEATHER AT GREENWICH IN MAY, 1906 & 1907.

I HAVE made notes of above, and the similitude of the two months being so striking, I thought it worthy of record. Here are the figures:—

|          | Mean.<br>bar. |     | Thermometer. |      |       |     | Rainfall.<br>inches. |     | Wind.<br>miles. |     | Sun.<br>hours. |     | Air.<br>frosts. |
|----------|---------------|-----|--------------|------|-------|-----|----------------------|-----|-----------------|-----|----------------|-----|-----------------|
|          |               |     | max.         | min. | mean. |     |                      |     |                 |     |                |     |                 |
| 1906 ... | 29.70         | ... | 62.3         | 44.3 | 53.3  | ... | 1.56                 | ... | 8410            | ... | 153            | ... | 1               |
| 1907 ... | 29.70         | ... | 62.2         | 44.3 | 53.25 | ... | 1.56                 | ... | 8283            | ... | 159            | ... | 1               |

Thus barometer, thermometer, and rainfall readings are practically identical, and wind and sunshine nearly so. The only variation is in the number of days' rainfall, which was 12 in 1906 and 18 in 1907.

ARTHUR F. PARBURY.

*Haslemere, Surrey, 6th June.*

### THE GLOOM OF APRIL, 1907.

THE unusual character of the past month is well shown for London by the fact that the quarter hours of day-darkness (*i.e.*, during office hours, 9 a.m. to 5 p.m., see this Magazine for January, 1902, Vol. 36, p. 194) were more than double the total of the previous 9 years of records, and even the number of days was as great.

This is shown by the following table :—

|                   | 1898. | '99. | 1900. | '01. | '02. | '03. | '04. | '05. | '06. | '07. | Total. |         | Mean.  |         |
|-------------------|-------|------|-------|------|------|------|------|------|------|------|--------|---------|--------|---------|
|                   |       |      |       |      |      |      |      |      |      |      | 9 yrs. | 10 yrs. | 9 yrs. | 10 yrs. |
| Days, April ..... | 0     | 1    | 1     | 1    | 1    | 1    | 1    | 3    | 0    | 10   | 9      | 19      | 1      | 1.9     |
| Quarterhrs., Apr. | 0     | 3    | 1     | 1    | 11   | 2    | 2    | 4    | 0    | 57   | 24     | 81      | 2.6    | 8.1     |
| Do., Apr. to Sep. | 2     | 11   | 5     | 14   | 21   | 42   | 9    | (8)  | 5    | —    | 134    | —       | 14.9   | —       |

The mean number of quarter hours in the various months (as given in the above-mentioned note) ran : October, 30 ; November, 91½ ; December, 131 ; January, 110 ; February, 35 ; March, 26 ; and total, April to September, 17. Hence the past April brought more darkness (mainly due to fog) than the average of any but the three foggiest months.

J. EDMUND CLARK.

8, Chiswell Street, E.C., 1st May, 1907.

### THUNDERSTORM OF JUNE 1st.

A HEAVY thunderstorm, accompanied by a deluge of rain, passed over this district between 11.35 a.m. and 12.15 p.m. on the above date. The storm came up from the N.W., and working round by the W. and S.W., passed away towards S. and S.E. along the North Downs.

Thunder was first heard at 11.35 a.m. At 11.44 a.m. the interval between lightning and thunder was two seconds. At noon the very vivid forked lightning was followed instantaneously by thunder. At 0.7 p.m. a vivid flash of forked lightning, bright blue in colour, was seen due W., the interval to thunder being 3 seconds. Thunder was last heard in the S. at 0.15 p.m.

Rain fell between 11.50 a.m. and 0.10 p.m., and the amount measured was .80 in. in 20 minutes. Very variable airs to a dead calm prevailed during the storm. Between 2.20 p.m. and 2.45 p.m. thunder was again heard in the S.W. and W., and between 5.45 p.m. and 6 p.m. in the N.E.

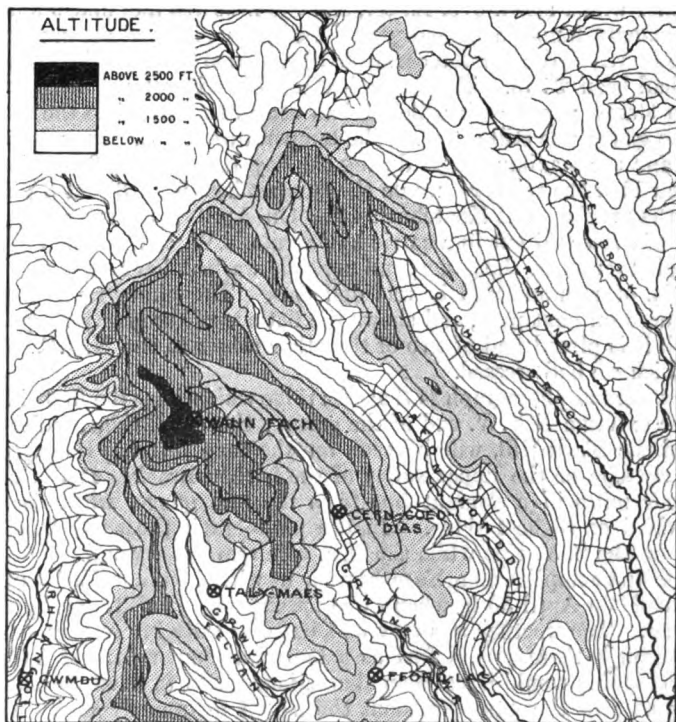
SPENCER C. RUSSELL, F.R.Met.Soc.

Epsom, June 1st, 1907.

## RAIN GAUGES ON THE BLACK MOUNTAINS.

By REV. R. P. DANSEY.

THIS mountain group lies in the counties of Brecon, Monmouth and Hereford, and is of great extent. It consists of four long ridges, each eight to twelve miles in length, separated by parallel valleys running S.S.E. The two northern of these give birth to streams which run north and then east, draining into the Monnow and then the Wye. The two southern run south and find their way into the Usk. The map below shows the contour lines for each 100 feet up to 1000 feet, and thereafter for each 250 feet to the summit. The closeness of the contour lines is of course proportional to the steepness of the mountain slope, and the rivers which are shown and named indicate the lowest lines of the valleys. The view of the mountains from the east is not very impressive, only the outline of the long straight ridge which forms the first rampart of the mountains being visible, low on the horizon, from my Rectory at Kentchurch, about 10 miles distant to the east.



BLACK MOUNTAINS.

ENGLISH MILES.  
0 1 2 3 4



Dr. H. R. Mill having kindly provided me with a rain gauge, I set it up on the 11th of March last at the point marked on the map as Waun Fach, at a height of 2500 feet, that is to say about 160 feet below the summit. The setting up of this long Bradford pattern rain gauge was not without difficulty; I had to carry it on my bicycle for 20 miles, the last 10 of which were extremely rough. When the bicycle had done its work it had taken me—and in bad places I had taken it—to Capel-y-ffin, over 1000 feet above sea level, in the valley of the Afon Honddu, close to the monastery of Father Ignatius. After a few minutes' rest, the "2nd" ridge to the S.W., over 2000 feet, had to be climbed, and a descent made into the next parallel valley, that of the Grwyne Fawr, and then the final ascent of Waun Fach, the summit of the whole group, was at last achieved.

My wife went with me to take the first measurement, on April 1st—the double journey making 40 miles on bicycles and 8 to 10 miles of walking, including the crossing of a ridge over 2000 feet twice, and dropping down to 1500 feet and then up again to 2660 feet, not a bad day's work for a lady. It was in the glorious anti-cyclonic weather which lasted over Easter, and the heat was like midsummer. The amount found in the gauge was 1.90 in., which had accumulated since March 11th; for the corresponding period at Kentchurch the fall had been .51 in. The gauge had not been interfered with, and some stamp paper with which I had sealed the funnel to the body of the gauge was still intact. The temperature on the summit was 56°, and the maximum here during the day had been 61°; and on March 11th the temperature on the summit had been 30° at 3 p.m., and the maximum at Kentchurch 44°. On April 1st there was one drift of snow still left in a corrie half-a-mile N.W. of the gauge.

I photographed the gauge, and my wife washed her face with the 1.90 in. of rain and said it was delicious. The photograph is reproduced on next page, and shows the flatness of the grassy ridge on which it is placed, and of two of the other ridges to the N.N.E., one of which we had crossed.

The second photograph is that of a ridge which joins the first ridge at the extreme N.N.W. end of the group; this small ridge, which is called the Black Hill, will be seen on the map forming the north-easterly side of the upper valley of the Olchon Brook. It is three or four miles in a straight line from the rain gauge, which is on the third or highest ridge. In the photograph the snow has all gone on the S.W. side while the N.E. side remains covered.

The first complete month's measurement with the Waun Fach gauge was made on April 30th, when I was accompanied in visiting it by my brother. The weather was very bad, but decidedly interesting. On the summit there was a furious gale and a temperature of 34° at 3 p.m., and it would have been almost impossible to have measured the water in the gauge without the help I fortunately had. The fall for April was found to be 5.85 in., against 3.33 in. at Kentchurch, which I may mention is only 210 feet above sea level. On our way

back to Capel-y-ffin a thick snow blizzard came on ; when crossing the second ridge, that between the Grwyne Fawr and Afon Honddu valley, at 2000 feet, temperature fell from  $40^{\circ}$  to  $32^{\circ}$ , and in a few minutes the whole place was white down to about 1500 feet. The storm lasted for about 20 minutes.



THE WAUN FACH RAIN GAUGE.

On June 1st the measurement for May was successfully taken, and a fine and warm day among extremely bad weather favoured me, the thunderstorms which prevailed in the London district not extending near here. The May fall was found to be 5.30 in., against 3.08 in. at Kentchurch.



THE BLACK HILL RIDGE OF THE BLACK MOUNTAINS.

The Black Mountains form an extremely interesting group from the point of view of rainfall, and from other points of view as well. They are too vast and inaccessible for the tourist, and the raven breeds unmolested in some of the rocky crags above Capel-y-ffin and elsewhere. Three rain gauges, originally set up by the London County Council, are being maintained in the lower valleys by Dr. Mill, their positions being shown on the map at Ffordlas, Tal-y-maes and Cwm-ddu. One has been started, I believe, by Mr. Baker-Gabb, of Abergavenny, at Cefn-coed-dias, and I understand that there are some gauges for a proposed water works in one of the valleys, but their positions are not known. It would, however, be very interesting to obtain further records on the ridges and especially at the upper ends of the valleys. If two gauges were set up between Capel-y-ffin and the summit gauge, they would all be "in the day's work" or rather "walk," so to speak, and would entail hardly any extra trouble, if means could be found to provide the instruments. Of course, in stations like this it is hopeless to expect a daily record of the rainfall, and it is impossible even to be sure of a monthly record read with absolute regularity on the first day of every month, but still, monthly readings, varying it may be by a day or two from the fixed date, can give extremely important information on the subject. Winter will be the most difficult time for obtaining systematic records; last winter the "Rain Gauge Ridge" was, I believe, never entirely without snow from November to April, and in severe frost a shaving lamp to melt the frozen water in the gauge will probably be a necessary article of equipment.

## REVIEWS.

*Verwandlung von Fahrenheitgraden in Centesimalgrade und umgekehrt* [Conversion of Fahrenheit degrees into Centigrade degrees and vice versa]. Von G. HELLMANN (Berlin). From the *Naturwissenschaftliche Rundschau* XXI., No. 38. Pp. 2.

DR. HELLMANN in this note points out a convenient rule for the conversion of the two thermometer scales—double the centigrade temperature, subtract one-tenth of this and add 32 to get the Fahrenheit temperature. Subtract 32 from the Fahrenheit temperature, halve this result and add one-tenth and one-hundredth of that half to get the centigrade temperature. The rules are very simple and obvious, and must have occurred to many workers. That for converting centigrade into Fahrenheit temperatures was published in the article *Thermometer* in the ninth edition of the *Encyclopædia Britannica* nearly twenty years ago, though Dr. Hellmann was not aware of this.

*The Physiography of the River Nile and its Basin.* By CAPTAIN H. G. LYONS, Director-General Survey Department. Cairo National Printing Department, 1906. Size  $11 \times 7\frac{1}{2}$ , pp. viii. + 412.

THIS is a remarkable work dealing with the physiography of the Nile, from its sources south of the Victoria Nyanza to its delta in the Mediterranean Sea. It deals in successive chapters with the different sections of the river and its chief tributaries, and the references to the very large literature of the subject appear to be exhaustive. The numerous maps are produced with a clearness and delicacy of colouring that reflect the greatest credit on the Survey Office at Cairo, and are far superior to those illustrating most Government publications in this country.

Captain Lyons gives monthly rainfall maps for the whole Nile Basin, which although necessarily founded on very incomplete data, succeed at least in bringing such data as do exist into a very reasonable relationship. The climate of the various parts of his vast region is treated very fully, most of the available figures being quoted, while the utmost use is made of the long records of the height of the Nile at different seasons. The book culminates in a masterly study of the variations of the Nile floods for the period of about 175 years throughout which the records appear to be trustworthy and comparable. With this unique set of observations of a quantity which is in the most intimate dependance on climate it is a little disappointing to learn that no regular alternation of high and low flood is to be found. Captain Lyons sums up the relations of meteorological conditions and the floods of the Nile as follows :—

“Turning to the meteorological conditions, atmospheric pressure in north-eastern Africa appears to vary inversely as the rainfall of Abyssinia, and a similar relation between pressure and rainfall has been demonstrated in other parts of the globe. The distribution of pressure in the summer months in the light of recent information shows that the Asiatic low pressure in the monsoon season is abruptly terminated about the meridian of the Nile valley, and to the west of this there is probably an area of almost equal pressure intervening between it and the high pressure of the Azores action-centre, while in summer a low pressure area may lie to the south-west. The encroachment of this high pressure on the eastern part of North Africa may produce there the unfavourable conditions of high pressure, which have been recognised as coinciding with deficient rainfall on the Abyssinian tableland, while conversely its withdrawal so as to allow of deepening or extension of the low pressure trough, probably acts favourably towards the conditions of precipitation in Abyssinia.

“It seems that the two principal factors to be considered are, firstly, the strength of the south-east trade winds as they progress from the south to the north of the equator, along the eastern coast of Africa, and secondly, the excess or defect of atmospheric pressure in the area represented by Aden, Cairo, Beirut, and the region lying to the west of this; the sub-equatorial rainfall in early summer must also be considered.

"So far as our knowledge goes at present it may be said that :—

"(1). Generally speaking the curve of Nile floods varies inversely as the mean barometric pressure of the summer months, high pressures accompany low floods, and low pressures accompany high floods.

"(2). These pressure variations show a great similarity over wide areas, but seem to be to some extent dependent upon the position of the Azores high pressure 'action-centre.'

"(3). Taking the monthly means of atmospheric pressure, this relation is even more clearly shown, and pressure above or below the normal in months of the rainy season of Abyssinia coincides closely with deficiency or excess of rainfall.

"(4). Taking the 37 years—1869 to 1905—in six years out of seven a very fairly accurate prediction of the flood from month to month could have been made, and there seems a reasonable probability that further and more detailed study of the conditions above described may increase the reliability.

"(5). The effect of excessive sub-equatorial rainfall in April and May in the neighbourhood of Zanzibar, seems to have a distinctly prejudicial effect on Abyssinian rains."

*Meteorological Observations at Stations of the Second Order.* Published by the Authority of the Meteorological Committee. For the year 1901, and for the year 1902. (Size 10 × 10. Pp. xiv. + 180. Price 22s. 6d. each.) Edinburgh: Printed for H.M. Stationery Office.

*Hourly Readings obtained from the Self-recording Instruments at four Observatories in connexion with the Meteorological Office.* Published by the Authority of the Meteorological Committee. 1903, 1904, 1905. Three volumes. (Size 12 × 10. Pp. xiv. + 198. Price 25s. each.) Printed for H.M. Stationery Office.

THE Meteorological Office has now come up to date in the matter of the publication of the volumes of "Hourly Readings," and we season our gratitude with the hope that the volumes of "Second Order" observations will soon be in an equally forward state. There is not much to be said as a rule of official publications, the successive volumes of which do not even vary in the number of their pages, but the last volume of Hourly Readings has an important announcement in the preface—viz., that the readings of the Robinson anemometer are now calculated on the basis that the movement of the wind is 2·2 times as fast as the speed of revolution of the cups. Former volumes gave the wind velocities calculated on the assumption that the wind moved with three times the speed of the cups. We accordingly warn those of our readers who are on the watch for evidence of secular change to deal warily with the wind records before and after 1905.

## METEOROLOGICAL NEWS AND NOTES.

MR. ANDREW WATT, M.A., has, we learn with pleasure, been appointed Meteorological Secretary of the Scottish Meteorological Society, in succession to the late Dr. Buchan.

M. ST. C. HEPITES has retired from the direction of the Rumanian Meteorological Institute at Bukharest, after having held the office for twenty-three years. He is succeeded by M. I. St. Murat, but will continue to interest himself in the scientific work being carried on at the Institute.

"BRITISH RAINFALL, 1906," has now reached that stage of compilation when it is urgent that all returns not already received must be sent in within a week, if they are to be inserted in the general table of rainfall. It is now too late to utilize such returns for the various detailed discussions of rainfall data.

MR. WILLIAM GRIFFITHS, who died this month at Holyhead, aged 81, is described in the *Liverpool Daily Post and Mercury* as a great weather prophet. The notice states "that before steam became general, hundreds of sailing vessels used Holyhead Refuge Harbour, and it was the custom for the masters of these craft to be guided in their sailings by the advice of deceased as to the coming weather. Deceased was the author of some treatises on meteorology and chronology, which were favourably reviewed by the Press. . . . In 1863 he predicted the gale known locally as 'the three-fingered Jack gale,' when thirty-three vessels broke from their moorings at Holyhead and went upon the rocks, with disastrous results."

MESSRS. PASTORELLI AND RAPKIN have forwarded a specimen of their "Meteorological Register" for hanging up. Twelve perforated sheets,  $8\frac{1}{2}$  by  $5\frac{1}{2}$  inches in size, are provided with a cardboard back and pencil at top. The sheet is ruled in the upper half for a barometer curve and in the lower half for observations of direction of wind, rainfall, maximum, minimum, wet and dry thermometers; but only for one daily reading. The register is neat and attractive, and the price is one shilling.

AN ORIGINAL REMARK ABOUT THE WEATHER was recently asked for in a prize competition by the *Westminster Gazette*, and the following—one of which we have heard before—won the two prizes:—

(1.) The gods became bored with their quiet lives on stormless Olympus. Zeus, fearing the effects of excessive nectarism, and thinking gambling the lesser evil, instituted a celestial form of "rouge et noir," the stakes for him who should successfully prophecy to-morrow's weather. Since then he has kept them pleasantly amused.

(2.) It was particularly wet in parts of Scotland during August of last year. A gentleman who had a shooting in a Perthshire glen remarked to an old gamekeeper that during the month they had four good days. "Yes," said the old man, "but the Sabbath 'nippet' up three of them."

## TEMPERATURE FOR MAY, 1907.

| STATION.                           | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |        |      |        | No. of Nights<br>at or below 32° |        |
|------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|--------|------|--------|----------------------------------|--------|
|                                    |                      |            |                      |                                | Max.         |        | Min. |        | Shade.                           | Grass. |
|                                    |                      |            |                      |                                | °            | Date.  | °    | Date.  |                                  |        |
| Camden Square.....                 | London.....          | 51 32      | 0 8                  | 111                            | 82.3         | 12     | 35.9 | 20     | 0                                | 1      |
| Tenterden.....                     | Kent.....            | 51 4       | 0 41                 | 190                            | 76.0         | 12     | 34.0 | 19, 20 | 0                                | 4      |
| West Dean.....                     | Hampshire.....       | 51 3       | 1 38                 | 137                            | 73.0         | 12     | 31.0 | 19     | 1                                | 7      |
| Hartley Wintney.....               | ".....               | 51 18      | 0 53                 | 222                            | 77.0         | 12     | 32.0 | 18, 19 | 2                                | 6      |
| Hitchin.....                       | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | 79.0         | 12     | 32.0 | 19     | 1                                | ...    |
| Winslow (Addington).....           | Buckinghamsh. ....   | 51 58      | 0 53                 | 309                            | 80.0         | 12     | 32.0 | 19     | 1                                | 3      |
| Bury St. Edmunds (Westley).....    | Suffolk.....         | 52 15      | 0 40                 | 226                            | 79.0         | 11     | 31.5 | 20     | 1                                | ...    |
| Brundall.....                      | Norfolk.....         | 52 37      | * 1 26               | 66                             | 80.0         | 11     | 33.8 | 21     | 0                                | 2      |
| Winterbourne Steepleton.....       | Dorset.....          | 50 42      | 2 31                 | 316                            | 66.8         | 12, 27 | 29.0 | 21     | 2                                | 5      |
| Torquay (Cary Green).....          | Devon.....           | 50 28      | 3 32                 | 12                             | 69.0         | 26     | 36.9 | 20     | 0                                | 0      |
| Polapit Tamar [Launceston].....    | ".....               | 50 40      | 4 22                 | 315                            | 69.2         | 28     | 30.1 | 20     | 2                                | 5      |
| Bath.....                          | Somerset.....        | 51 23      | 2 21                 | 67                             | 76.0         | 12     | 35.0 | 18     | 0                                | ...    |
| Stroud (Upfield).....              | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 76.0         | 12     | 42.0 | 18     | 0                                | ...    |
| Church Stretton (Wooltaston).....  | Shropshire.....      | 52 35      | 2 48                 | 800                            | 76.0         | 12     | 26.0 | 19, 22 | 13                               | ...    |
| Coventry Kingswood.....            | Warwickshire.....    | 1 30       | 52 24                | 340                            | 68.0         | 6, 25  | 35.0 | 18, 21 | 0                                | ...    |
| Boston.....                        | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 81.0         | 12     | 35.0 | 5, 18  | 0                                | ...    |
| Workop (Hodsock Priory).....       | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 80.6         | 12     | 30.3 | 22     | 2                                | 9      |
| Derby (Midland Railway).....       | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 83.0         | 12     | 31.0 | 21     | 1                                | ...    |
| Bolton (Queen's Park).....         | Lancashire.....      | 53 35      | 2 28                 | 390                            | 70.4         | 12     | 33.4 | 22     | 0                                | 4      |
| Wetherby (Ribston Hall).....       | Yorkshire, W.R. .... | 53 59      | 1 24                 | 130                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Arncliffe Vicarage.....            | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Hull (Pearson Park).....           | " E.R. ....          | 53 45      | 0 20                 | 6                              | 80.0         | 11     | 35.0 | 22     | 0                                | 10     |
| Newcastle (Town Moor).....         | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Borrowdale (Seathwaite).....       | Cumberland.....      | 54 30      | 3 10                 | 423                            | 69.5         | 24     | 34.3 | 2      | 0                                | ...    |
| Cardiff (Ely).....                 | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...    | ...  | ...    | ...                              | ...    |
| Haverfordwest (High Street).....   | Pembroke.....        | 51 48      | 4 58                 | 95                             | 71.3         | 28     | 34.3 | 22     | 0                                | 0      |
| Aberystwyth (Gogerddan).....       | Cardigan.....        | 52 26      | 4 1                  | 83                             | 78.0         | 28     | 27.0 | 17     | ...                              | ...    |
| Llandudno.....                     | Carnarvon.....       | 53 20      | 3 50                 | 72                             | ...          | ...    | ...  | ...    | ...                              | ...    |
| Cargen [Dunfries].....             | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 68.0         | 24     | 32.0 | 23     | 1                                | ...    |
| Lilliesleaf (Riddell House).....   | Rozburgh.....        | 55 31      | 2 46                 | 550                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Edinburgh (Royal Observatory)..... | Midlothian.....      | 55 55      | 3 11                 | 442                            | 64.5         | 13     | 34.8 | 2      | 0                                | 2      |
| Girvan (Pinnore).....              | Ayr.....             | 4 49       | 55 10                | 207                            | 66.0         | 24, 27 | 31.0 | 19     | 2                                | ...    |
| Glasgow (Queen's Park).....        | Renfrew.....         | 55 53      | 4 18                 | 144                            | 68.0         | 27     | 34.0 | 15, 17 | 0                                | 2      |
| Tighnabruach.....                  | Argyll.....          | 55 55      | 5 14                 | 50                             | 66.0         | 27     | 32.0 | 14, 18 | 2                                | 3      |
| Mull (Quinish).....                | ".....               | 56 36      | 6 13                 | 35                             | 68.0         | 26     | ...  | ...    | ...                              | ...    |
| Dundee (Eastern Necropolis).....   | Forfar.....          | 56 28      | 2 57                 | 199                            | 69.1         | 13     | 35.0 | 29     | 0                                | ...    |
| Braemar.....                       | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...    | ...  | ...    | ...                              | ...    |
| Aberdeen (Cranford).....           | ".....               | 57 8       | 2 7                  | 120                            | 63.0         | 10†    | 30.0 | 4      | 1                                | ...    |
| Cawdor (Budgate).....              | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Invergarry.....                    | E. Inverness.....    | 57 4       | 4 47                 | 130?                           | ...          | ...    | ...  | ...    | ...                              | ...    |
| Loch Torridon (Bendamph).....      | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...    | ...  | ...    | ...                              | ...    |
| Dunrobin Castle.....               | Sutherland.....      | 57 59      | 3 56                 | 14                             | 61.0         | 11     | 34.0 | 19     | 0                                | 0      |
| Castletown.....                    | Caitness.....        | 58 35      | 3 23                 | 100                            | 69.0         | 26     | 30.0 | 3, 4   | 4                                | ...    |
| Killarney (District Asylum).....   | Kerry.....           | 52 4       | 9 31                 | 178                            | 72.5         | 29     | 34.5 | 23     | 0                                | ...    |
| Waterford (Brook Lodge).....       | Waterford.....       | 52 15      | 7 7                  | 104                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Broadford (Hurdlestown).....       | Clare.....           | 52 48      | 8 38                 | 167                            | 72.0         | 27     | 32.0 | 4      | 1                                | ...    |
| Abbey Leix (Blandsfort).....       | Queen's County.....  | 52 56      | 7 17                 | 532                            | 66.0         | 26, 27 | ...  | ...    | ...                              | ...    |
| Dublin (Fitz William Square).....  | Dublin.....          | 53 21      | 6 14                 | 54                             | 67.5         | 27     | 34.4 | 1      | 0                                | 1      |
| Ballinasloe.....                   | Galway.....          | 53 20      | 8 15                 | 160                            | 76.0         | 25, 27 | 27.0 | 18     | 7                                | ...    |
| Clifden (Kylemore House).....      | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Crossmolina (Enniscoe).....        | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...    | ...  | ...    | ...                              | ...    |
| Seaforde.....                      | Down.....            | 54 19      | 5 50                 | 180                            | 71.0         | 27     | 32.0 | 22     | 1                                | 2      |
| Londonderry (Creggan Res.).....    | Londonderry.....     | 54 59      | 7 19                 | 320                            | ...          | ...    | ...  | ...    | ...                              | ...    |
| Omagh (Edenfel).....               | Tyrone.....          | 54 36      | 7 18                 | 280                            | 68.0         | 28     | 32.0 | 18     | 0                                | ...    |

† and 11, 14, 23.

## RAINFALL FOR MAY, 1907.

| RAINFALL OF MONTH. |       |                    |          |                   |             | RAINFALL FROM JAN. 1. |       |                      |          | Mean Annual 1870-1899. | STATION.             |
|--------------------|-------|--------------------|----------|-------------------|-------------|-----------------------|-------|----------------------|----------|------------------------|----------------------|
| Aver. 1870-99.     | 1907. | Diff. from Av. in. | % of Av. | Max. in 24 hours. | No. of Days | Aver. 1870-99.        | 1907. | Diff. from Aver. in. | % of Av. |                        |                      |
| in.                | in.   |                    |          | in. Date.         |             | in.                   | in.   |                      |          | in.                    |                      |
| 1.72               | 1.74  | + .02              | 101      | .28 7             | 17          | 8.54                  | 8.01  | - .53                | 94       | 25.16                  | Camden Square        |
| 1.72               | 2.01  | + .29              | 117      | .31 2             | 18          | 9.59                  | 8.47  | - 1.12               | 88       | 28.36                  | Tenterden            |
| 1.86               | 2.15  | + .29              | 116      | .54 13            | 19          | 10.59                 | 9.52  | - 1.07               | 90       | 29.93                  | West Dean            |
| 1.79               | 1.65  | - .14              | 92       | .36 11            | 16          | 9.70                  | 9.23  | - .47                | 95       | 27.10                  | Hartley Wintney      |
| 1.87               | 3.19  | + 1.32             | 170      | .85 13            | 21          | 8.37                  | 8.97  | + .60                | 107      | 24.66                  | Hitchin              |
| 2.06               | 2.96  | + .90              | 144      | 1.40 13           | 17          | 9.29                  | 8.83  | - .46                | 95       | 26.75                  | Addington            |
| 1.85               | 3.52  | + 1.67             | 190      | 1.01 13           | 18          | 8.28                  | 10.21 | + 1.93               | 123      | 25.39                  | Westley              |
| 1.74               | 2.57  | + .83              | 148      | .65 31            | 19          | 8.23                  | 10.66 | + 2.43               | 130      | 25.40                  | Brundall             |
| 2.02               | 2.17  | + .15              | 107      | .34 1             | 18          | 14.04                 | 11.95 | - 2.09               | 85       | 39.00                  | Winterbourne Stilton |
| 1.96               | 3.48  | + 1.52             | 178      | .51 6             | 21          | 12.92                 | 11.55 | - 1.37               | 85       | 35.00                  | Torquay              |
| 1.98               | 3.06  | + 1.08             | 155      | .45 9             | 21          | 13.33                 | 13.28 | - .05                | 100      | 38.85                  | Polapit Tamar        |
| 2.09               | 2.97  | + .88              | 142      | .58 13            | 17          | 10.72                 | 9.73  | - .99                | 91       | 30.75                  | Bath                 |
| 2.10               | 1.77  | - .33              | 84       | .26 22            | 18          | 10.60                 | 8.62  | - 1.98               | 81       | 29.85                  | Stroud               |
| 2.62               | 3.05  | + .43              | 116      | .58 6             | 19          | 11.85                 | 10.73 | - 1.12               | 91       | 33.04                  | Woolstaston          |
| 2.11               | 4.80  | + 2.69             | 227      | 2.37 13           | 18          | 10.15                 | 9.73  | - .42                | 96       | 29.21                  | Coventry             |
| 1.73               | 3.08  | + 1.35             | 178      | .75 14            | 18          | 7.82                  | 8.09  | + .27                | 103      | 23.30                  | Boston               |
| 2.01               | 2.91  | + .90              | 145      | .44 31            | 23          | 8.57                  | 8.21  | - .36                | 96       | 24.70                  | Hodsock Priory       |
| 1.96               | 3.84  | + 1.88             | 196      | .67 14            | 19          | 8.78                  | 9.86  | + 1.08               | 112      | 26.18                  | Derby                |
| 2.46               | 4.38  | + 1.92             | 178      | .79 30            | 21          | 13.54                 | 14.90 | + 1.36               | 110      | 42.43                  | Bolton               |
| 1.90               | 3.66  | + 1.76             | 193      | .78 31            | 19          | 9.25                  | 9.99  | + .74                | 108      | 26.96                  | Ribston Hall         |
| 3.36               | 5.41  | + 2.05             | 161      | 1.35 30           | 22          | 22.78                 | 25.34 | + 2.56               | 111      | 60.96                  | Auncliffe Vic.       |
| 1.95               | 3.91  | + 1.96             | 201      | .92 31            | 23          | 9.12                  | 9.28  | + .16                | 102      | 27.02                  | Hull                 |
| 1.89               | 4.36  | + 2.47             | 231      | 1.10 14           | 21          | 9.32                  | 9.75  | + .43                | 105      | 27.99                  | Newcastle            |
| 7.26               | 10.18 | + 2.92             | 140      | 2.56 1            | 21          | 50.39                 | 46.14 | - 4.25               | 92       | 132.68                 | Seathwaite           |
| 2.55               | 2.83  | + .28              | 111      | .48 3             | 18          | 14.66                 | 12.89 | - 1.77               | 88       | 42.81                  | Cardiff              |
| 2.53               | 3.58  | + 1.05             | 141      | .73 30            | 16          | 17.06                 | 14.05 | - 3.01               | 82       | 47.88                  | Haverfordwest        |
| 2.44               | 3.79  | + 1.35             | 155      | 1.59 6            | 13          | 14.66                 | 14.85 | + .19                | 101      | 45.41                  | Gogerddan            |
| 1.85               | 1.64  | - .21              | 89       | .31 30            | 19          | 10.18                 | 7.66  | - 2.52               | 75       | 30.98                  | Llandudno            |
| 2.60               | 5.44  | + 2.84             | 209      | .86 1             | 17          | 16.07                 | 17.63 | + 1.56               | 110      | 43.43                  | Cargen               |
| 2.07               | ...   | ...                | ...      | ...               | ...         | 11.44                 | ...   | ...                  | ...      | 33.04                  | Riddell House        |
| ...                | 2.75  | ...                | ...      | .77 21            | 19          | ...                   | 7.74  | ...                  | ...      | ...                    | Edinburgh            |
| 2.73               | 4.66  | + 1.93             | 171      | .99 30            | 22          | 17.57                 | ...   | ...                  | ...      | 48.87                  | Girvan               |
| 2.36               | 4.08  | + 1.72             | 173      | .66 21            | 18          | 12.24                 | 14.94 | + 2.70               | 122      | 35.80                  | Glasgow              |
| 3.21               | 4.68  | + 1.47             | 146      | .53 1, 21         | 16          | 20.89                 | 22.75 | + 1.86               | 109      | 57.90                  | Tighnabruich         |
| 2.91               | 3.74  | + .83              | 128      | .92 1             | 19          | 20.29                 | 21.45 | + 1.16               | 106      | 57.53                  | Quinish              |
| 1.88               | 4.20  | + 2.32             | 223      | 1.05 31           | 19          | 9.94                  | 9.80  | - .14                | 99       | 28.95                  | Dundee               |
| 2.29               | 3.73  | + 1.44             | 163      | ...               | ...         | 12.50                 | 13.11 | + .61                | 105      | 36.07                  | Braemar              |
| 2.20               | 4.36  | + 2.16             | 198      | .97 31            | 22          | 11.60                 | 11.24 | - .36                | 97       | 33.01                  | Aberdeen             |
| 2.03               | 3.29  | + 1.26             | 162      | .84 21            | 17          | 9.68                  | 10.95 | + 1.27               | 113      | 29.37                  | Cawdor               |
| 2.84               | 4.09  | + 1.25             | 144      | 1.21 1            | 10          | 21.87                 | 26.78 | + 4.91               | 122      | 56.00                  | Invergarry           |
| 5.05               | 4.52  | - .53              | 90       | 1.75 1            | 17          | 31.26                 | 40.85 | + 9.59               | 131      | 86.50                  | Bendamp              |
| 2.02               | 2.18  | + .16              | 108      | .78 31            | 12          | 11.31                 | 13.65 | + 2.34               | 121      | 31.60                  | Dunrobin Castle      |
| ...                | 1.32  | ...                | ...      | .55 21            | 14          | ...                   | 12.90 | ...                  | ...      | ...                    | Castletown           |
| 2.95               | 4.04  | + 1.09             | 137      | .82 6, 10         | 18          | 22.70                 | 15.77 | - 6.93               | 69       | 58.11                  | Killarney            |
| 2.11               | ...   | ...                | ...      | ...               | ...         | 14.58                 | ...   | ...                  | ...      | 39.30                  | Waterford            |
| 2.09               | 2.66  | + .57              | 127      | .44 29            | 16          | 11.60                 | 12.45 | + .85                | 107      | 33.47                  | Hurdlestown          |
| 2.27               | 3.51  | + 1.24             | 155      | .64 6             | 19          | 12.77                 | 12.04 | - .73                | 94       | 35.19                  | Abbey Leix           |
| 1.94               | 3.21  | + 1.27             | 165      | 1.12 6            | 17          | 9.93                  | 9.49  | - .44                | 96       | 27.75                  | Dublin               |
| 2.49               | 3.71  | + 1.22             | 149      | .84 6             | 20          | 13.23                 | 13.55 | + .32                | 102      | 37.04                  | Ballinasloe          |
| 4.61               | 4.69  | + .08              | 102      | 1.20 30           | 13          | 28.96                 | 24.70 | - 4.26               | 85       | 80.23                  | Kylemore House       |
| 2.93               | 5.07  | + 2.14             | 173      | .84 6             | 22          | 18.79                 | 20.53 | + 1.74               | 109      | 50.50                  | Ennisce              |
| 2.45               | 5.73  | + 3.28             | 234      | 1.39 30           | 21          | 14.20                 | 14.99 | + .79                | 106      | 38.61                  | Seaford              |
| 2.48               | 4.01  | + 1.53             | 162      | .66 30            | 19          | 14.15                 | 20.59 | + 6.44               | 146      | 41.20                  | Londonderry          |
| 2.43               | 3.60  | + 1.17             | 148      | ...               | ...         | 12.98                 | 16.64 | + 3.66               | 128      | 37.85                  | Omagh                |



## SUPPLEMENTARY RAINFALL, MAY, 1907.

| Div.  | STATION.                      | Rain.<br>inches | Div.   | STATION.                    | Rain.<br>inches |
|-------|-------------------------------|-----------------|--------|-----------------------------|-----------------|
| II.   | Abinger Hall .....            | 3.26            | XI.    | Rhayader, Tyrmynydd .....   | ...             |
| „     | Ramsgate .....                | 2.38            | „      | Lake Vyrnwy .....           | 3.92            |
| „     | Hailsham .....                | 3.11            | „      | Llangyhanfal, Plas Draw.... | 2.53            |
| „     | Crowborough, Uckfield Lodge   | 2.89            | „      | Criccieth, Talarvor.....    | 2.30            |
| „     | Totland Bay, Aston House.     | 1.65            | „      | Llanberis, Pen-y-pass ..... | 7.78            |
| „     | Emsworth, Redlands.....       | 2.87            | „      | Lligwy .....                | 2.67            |
| „     | Alton, Ashdell .....          | 2.12            | „      | Douglas, Woodville .....    | 3.54            |
| „     | Newbury, Welford Park ...     | 2.14            | XII.   | Stoneykirk, Ardwell House   | 4.18            |
| III.  | Harrow Weald, Hill House.     | 1.69            | „      | Dairy, The Old Garroch ...  | 6.08            |
| „     | Oxford, Magdalen College..    | 2.37            | „      | Langholm, Grove Road .....  | 5.64            |
| „     | Bloxham Grove .....           | 3.16            | „      | Moniaive, Maxwellton House  | 5.37            |
| „     | Pitsford, Sedgebrook .....    | 4.93            | XIII.  | N. Esk Reservoir [Penicuik] | 3.30            |
| „     | Huntingdon, Brampton .....    | 4.32            | XIV.   | Maybole, Knockdon Farm..    | 3.85            |
| „     | Wisbech, Bank House .....     | 1.89            | XV.    | Campbeltown, Witchburn..    | 5.91            |
| IV.   | Southend Water Works.....     | 2.14            | „      | Inveraray, Newtown .....    | 4.96            |
| „     | Colchester, Lexden .....      | 2.29            | „      | Ballachulish House.....     | 7.56            |
| „     | Newport, The Vicarage .....   | 2.84            | „      | Islay, Eallabus .....       | 4.29            |
| „     | Rendlesham .....              | 1.92            | XVI.   | Dollar Academy .....        | 4.66            |
| „     | Swaffham .....                | 2.44            | „      | Loch Leven Sluice .....     | 3.69            |
| „     | Blakeney .....                | 2.51            | „      | Balquhider, Stronvar .....  | 5.01            |
| V.    | Bishops Cannings .....        | 2.27            | „      | Perth, Pitcullen House..... | 3.04            |
| „     | Ashburton, Druid House ...    | 5.67            | „      | Coupar Angus Station .....  | 3.34            |
| „     | Okehampton, Oaklands.....     | 4.20            | „      | Blair Atholl .....          | 2.90            |
| „     | Hartland Abbey .....          | 3.08            | „      | Montrose, Sunnyside Asylum  | 5.73            |
| „     | Lynmouth, Rock House ...      | 3.28            | XVII.  | Alford, Lynturk Manse ...   | 4.55            |
| „     | Probus, Lamellyn .....        | 2.27            | „      | Keith Station .....         | 2.98            |
| „     | Wellington, The Avenue ...    | ...             | XVIII. | N. Uist, Lochmaddy .....    | 3.24            |
| „     | North Cadbury Rectory ..      | 1.58            | „      | Alvey Manse .....           | 1.69            |
| VI.   | Clifton, Pembroke Road ...    | 2.61            | „      | Loch Ness, Drumnadrochit.   | 2.09            |
| „     | Ross, The Graig .....         | 2.26            | „      | Glencarron Lodge .....      | 3.92            |
| „     | Shifnal, Hatton Grange .....  | 3.18            | „      | Fearn, Lower Pitkerrie..... | 2.49            |
| „     | Cheadle, The Heath House.     | 3.72            | XIX.   | Invershin .....             | 3.79            |
| „     | Blockley, Upton Wold .....    | 2.78            | „      | Altnaharra .....            | 2.44            |
| „     | Worcester, Boughton Park.     | 2.74            | „      | Bettyhill .....             | 2.05            |
| VII.  | Market Overton .....          | 4.14            | XX.    | Dunmanway, The Rectory..    | 6.27            |
| „     | Market Rasen .....            | 2.95            | „      | Cork .....                  | 3.58            |
| „     | Bawtry, Hesley Hall.....      | 3.16            | „      | Darrynane Abbey .....       | 4.00            |
| VIII. | Neston, Hinderton Lodge...    | 2.79            | „      | Glenam [Clonmel] .....      | 3.44            |
| „     | Southport, Hesketh Park...    | 3.23            | „      | Ballingarry, Gurteen .....  | 2.58            |
| „     | Chatburn, Middlewood .....    | 3.80            | „      | Miltown Malbay.....         | 3.14            |
| „     | Cartmel, Flookburgh .....     | 5.29            | XXI.   | Gorey, Courtown House ...   | 4.18            |
| IX.   | Langsett Moor, Up. Midhope    | 5.48            | „      | Moynalty, Westland .....    | 4.41            |
| „     | Scarborough, Scalby .....     | 3.54            | „      | Athlone, Twyford .....      | 2.78            |
| „     | Ingleby Greenhow .....        | 3.58            | „      | Mullingar, Belvedere.....   | 3.53            |
| „     | Mickleton .....               | 3.38            | XXII.  | Woodlawn .....              | 4.10            |
| X.    | Bardon Mill, Beltingham ...   | 2.91            | „      | Westport, Murriak Abbey..   | ...             |
| „     | Ewesley, Fallowles .....      | 4.65            | „      | Collooney, Markree Obay..   | 4.24            |
| „     | Iliderton, Lilburn Cottage... | 3.82            | „      | Mohill .....                | 4.42            |
| „     | Keswick, York Bank .....      | 4.86            | XXIII. | Enniskillen, Portora .....  | 3.55            |
| XI.   | Llanfrechfa Grange.....       | 3.69            | „      | Warrenpoint, Summer Hill.   | 2.72            |
| „     | Treherbert, Tyn-y-waun .....  | 4.87            | „      | Banbridge, Milltown .....   | 3.47            |
| „     | Carmarthen, The Friary.....   | 3.59            | „      | Belfast, Springfield .....  | 4.09            |
| „     | Castle Malgwyn [Llechryd].    | 3.77            | „      | Bushmills, Dundarave .....  | 3.97            |
| „     | Plynlimon.....                | 5.95            | „      | Stewartstown, The Square..  | 4.03            |
| „     | Tall-y-llyn .....             | ...             | „      | Killybegs .....             | 4.84            |
| „     | New Radnor, Ednol .....       | 4.06            | „      | Horn Head ... ..            | 4.52            |

## METEOROLOGICAL NOTES ON MAY, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—A normal month in most respects. The temp., although the mean was  $54^{\circ}3$ , or  $0^{\circ}3$  above the average, was as a rule low, except during short periods in the second and fourth weeks. Polar winds rather preponderated and the amount of cloud was abnormally large. Duration of sunshine  $137^{\circ}0^*$  hours, and of R  $35.9$  hours.

CROWBOROUGH.—A wet month, the R being  $.84$  in. above the average of 36 years, reducing the deficiency during 1907 to  $.15$  in. The month opened with boisterous, cold and unsettled weather till 4th, and cold and warm periods alternated throughout. Severe TS from 8.30 to 11 p.m. on 25th. Mean temp.  $51^{\circ}4$ .

BURY ST. EDMUNDS.—Very wet; the R had been exceeded only twice in May during 60 years.

NORTH CADBURY.—Excessively cloudy and rather windy. The day temp. was somewhat low but the nights were too cloudy to be cold. It was rainy but not wet.

COVENTRY.—A remarkable R began at about 10 p.m. on 13th, lasting continuously for 43 hours: total  $2.78$  in. We only just escaped a heavy flood.

SOUTHPORT.—Very dull and decidedly wet, with an exceptional prevalence of easterly winds, sea breezes being largely in defect. There were frequent trying changes of temp., but the mean,  $50^{\circ}7$  was only  $0^{\circ}4$  below the average. Duration of sunshine  $151.5^*$  hours, or 61 hours below the average. R  $1.13$  in. above the average. Duration of R  $78.0^*$  hours.

BOLTON.—Except for short intervals the temp. was much below the average, the mean being  $48^{\circ}6$ , or  $0^{\circ}8$  below. R was decidedly in excess and the largest in May since 1886. Duration of sunshine,  $99.7^*$  hours, or  $47.1$  hours below the average. The wind during a great part of the month was from the E.

HAVERFORDWEST.—Wet and stormy till 11th, then fine, but cold throughout and vegetation backward. Duration of sunshine  $170.7^*$  hours.

DOUGLAS.—If May, 1906, could be describable as "deplorable," May, 1907, deserves a stronger condemnation—it was execrable! Beginning with a continuance of a N.W. gale of over 70 hours' duration, cruelly blackening young foliage and fruit blossom, it was exceptionally windy throughout. R daily till 12th, often heavy and always cold, followed by a week of fine though cold weather, then excepting four warmer and calm days from 24th to 27th, it was again wet and gloomy with bitter E. winds to the end.

COUPAR ANGUS.—R  $1.27$  in. above the average. Mean temp.  $46^{\circ}3$ , or  $2^{\circ}0$  below the average.

DRUMNABOCHIT.—Remarkably cold with E. or N. wind. Frosts on several nights and new S frequently on the higher hills. R  $.04$  in. below, and rain days equal to, the average.

CASTLETOWN.—Except a few days from 8th to 14th and again from 24th to 26th, the month was harsh and cold with prevailing N.E. and E. winds.

DUNMANWAY.—Very wet for May, especially in the first fortnight and the last three days; from midnight on 28th to 10 a.m. on 31st it rained with scarcely a break. From 14th to 24th was dry and cold with night frosts, but 27th and 28th were very hot.

MILTOWN MALBAY.—Icy gales with H and R prevailed till 15th, thence to 21st was frosty, dry and cold. More genial with a spurt in vegetation till 27th, but cold and rainy at the end.

DUBLIN.—Cold, generally cloudy and cheerless. N.E. and E. winds predominated. R fell to the amount of  $2.52$  in. on the first 12 days, of which  $1.12$  in. fell in a TS on 6th. Mean temp.  $51^{\circ}4$ , or  $0^{\circ}7$  below the average.

BANBRIDGE.—R  $1.47$  in. above the average of 45 years.

\* Campbell-Stokes.

## Climatological Table for the British Empire, December, 1906.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |       |               |           | Absolute.       |                   | Total Rain |       | Aver. |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|-------|---------------|-----------|-----------------|-------------------|------------|-------|-------|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min.  | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Max. on<br>Grass. | Depth.     | Days. |       |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |       |               |           |                 |                   |            |       |       |
| London, Camden Square                                            | 55·1      | 3     | 20·9     | 27    | 42·0     | 32·9  | 35·4          | 90        | 76·0            | 17·7              | 2·21       | 19    | ...   |
| Malta ... ..                                                     | ...       | ...   | ...      | ...   | ...      | ...   | ...           | ...       | ...             | ...               | ...        | ...   | ...   |
| Lagos ... ..                                                     | 94·0      | 7     | 71·0     | 27    | 87·7     | 74·9  | 75·4          | 81        | 150·0           | 68·0              | ·58        | 2     | 6·1   |
| Cape Town ... ..                                                 | 92·3      | 6     | 50·5     | 22    | 75·0     | 58·1  | 54·8          | 68        | ...             | ...               | 3·23       | 10    | 4·9   |
| Durban, Natal ... ..                                             | 89·3      | 4     | 60·3     | 7     | 81·5     | 66·0  | ...           | ...       | 154·3           | ...               | 6·96       | 19    | 5·9   |
| Johannesburg ... ..                                              | 79·8      | 20    | 47·0     | 2     | 72·8     | 53·3  | 51·8          | 72        | 154·3           | 44·5              | 4·39       | 16    | 5·4   |
| Mauritius ... ..                                                 | 88·9      | 18    | 65·1     | 19    | 84·7     | 69·5  | 65·3          | 69        | 152·3           | 57·1              | 4·52       | 14    | 6·6   |
| Calcutta... ..                                                   | 82·3      | 13    | 52·7     | 23    | 78·2     | 58·0  | 57·0          | 70        | 145·5           | 45·6              | ·00        | 0     | 3·5   |
| Bombay... ..                                                     | 91·1      | 9     | 69·3     | 15    | 86·3     | 71·3  | 65·8          | 67        | 136·4           | 59·9              | ·00        | 0     | 0·7   |
| Madras ... ..                                                    | 84·9      | 23    | 63·4     | 3     | 81·6     | 71·4  | 70·5          | 85        | 135·4           | 58·0              | 16·43      | 13    | 6·3   |
| Kodaikanal ... ..                                                | 67·8      | 4     | 43·6     | 12    | 60·4     | 48·3  | 47·7          | 81        | 135·2           | 30·6              | 8·19       | 18    | 6·6   |
| Colombo, Ceylon ... ..                                           | 90·6      | 22    | 70·2     | 27    | 86·1     | 73·2  | 71·7          | 81        | 150·0           | 66·2              | 1·91       | 12    | 4·8   |
| Hongkong ... ..                                                  | 78·4      | 21    | 50·3     | 26    | 68·9     | 59·6  | 54·2          | 70        | 130·2           | ...               | ·86        | 4     | 4·9   |
| Melbourne ... ..                                                 | 96·8      | 22    | 44·3     | 26    | 75·6     | 53·6  | 51·0          | 63        | 155·0           | 85·0              | ·74        | 7     | 5·5   |
| Adelaide ... ..                                                  | 108·7     | 9     | 43·0     | 4     | 83·8     | 59·6  | 51·0          | 48        | 161·0           | 41·6              | 1·54       | 5     | 3·9   |
| Coorg, India ... ..                                              | 105·8     | 6     | 51·0     | 24    | 91·6     | 62·6  | 49·2          | 53        | 175·0           | 49·2              | ·25        | 3     | 2·8   |
| Sydney ... ..                                                    | 89·9      | 17    | 55·0     | 27    | 76·8     | 62·4  | 58·4          | 64        | 131·2           | 46·1              | 1·61       | 14    | 4·9   |
| Wellington ... ..                                                | 69·3      | 31    | 46·2     | 30    | 65·2     | 54·1  | 49·2          | 68        | 138·0           | 36·0              | 1·14       | 7     | 3·5   |
| Auckland ... ..                                                  | ...       | ...   | ...      | ...   | ...      | ...   | ...           | ...       | ...             | ...               | ...        | ...   | ...   |
| Jamaica, Negril Point.                                           | 88·9      | 10    | 64·3     | 26    | 83·7     | 68·9  | 65·2          | 69        | ...             | ...               | ·10        | 1     | ...   |
| Trinidad ... ..                                                  | ...       | ...   | ...      | ...   | ...      | ...   | ...           | ...       | ...             | ...               | ...        | ...   | ...   |
| Grenada ... ..                                                   | 85·4      | 11    | 70·8     | 22    | 83·0     | 73·0  | 74·1          | 84        | 146·2           | ...               | 7·40       | 21    | 3·4   |
| Toronto ... ..                                                   | 43·9      | 31    | ·8·1     | 8     | 29·8     | 15·2  | 21·4          | 86        | 56·8            | ·15·0             | 1·34       | 5     | 7·3   |
| Fredericton ... ..                                               | 43·2      | 22    | ·24·3    | 10    | 24·7     | 6·0   | ...           | 81        | ...             | ...               | 1·51       | 4     | 6·0   |
| St. John's, N.B. ... ..                                          | 49·8      | 21    | ·9·3     | 9     | 32·0     | 15·2  | ...           | 82        | ...             | ...               | 3·05       | 11    | 6·4   |
| Victoria, B.C. ... ..                                            | 52·5      | 22    | 28·3     | 27    | 45·1     | 37·4  | ...           | 93        | ...             | ...               | 3·82       | 18    | 8·3   |
| Dawson ... ..                                                    | 8·0       | 26    | ·55·0    | 5     | ·17·4    | ·27·1 | ...           | ...       | ...             | ...               | ·00        | 0     | 5·2   |

*Johannesburg.*—Rainfall above the average.

*Mauritius.*—Mean temp. of the air 1°·7, dew point 2°·3, relative humidity 1·8 per cent., and E 37 in. below, averages. Mean hourly velocity of wind 10·0 miles, or 0·8 below average.

*MADRAS.*—E over three times the normal for the month, and on the 13th more than 4 inches fell in 24 hours. TS on one day. Bright sunshine 124·3 hours.

*KODAIKANAL.*—Bright sunshine 129 hours. A stormy month.

*COLOMBO.*—Mean temp. of air 79°·4, or 0°·2 above, of dew point 0°·8 above, and E 3·86 in. below, averages. Mean hourly velocity of wind 7·6 miles.

*HONGKONG.*—Mean temp. of air 63°·5. Bright sunshine 194·4 hours. Mean hourly velocity of wind 11·8 miles.

*Adelaide.*—Mean temp. of air 0°·3 above, and E 71 in. above, averages.

*Sydney.*—Mean temp. of air 0°·3 above, and E 88 in. below, averages.

*Wellington.*—E 1·90 in. below the average, a dry and sunny month.

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## Alexander Buchan.

KINNESSWOOD, 11TH APRIL, 1829—EDINBURGH, 13TH MAY, 1907.

THE death of the leading British meteorologist deprives our science of one of the few survivors of the great formative period of modern meteorology, and takes from the workers in that subject an honoured master and a trusty friend. We, ourselves, owe much to the example and teaching of Dr. Buchan in observing and discussing the records of meteorological instruments, and more to the constant inspiration of his example and his kindly encouragement.

Alexander Buchan was born in Kinnesswood, Kinross, on 11th April, 1829, and was educated at the Free Church Normal School, in Edinburgh, and afterwards at the University, where he took the degree of M.A., in 1864. From 1848 onwards he followed the profession of a teacher, for which indeed he was naturally gifted, and throughout his life he retained the power of imparting instruction easily and pleasantly. As a schoolmaster he filled appointments at Banchory, Blackford, and lastly at Dunkeld. But for a weakness in the throat that continued to trouble him through life he might never have relinquished the profession he had chosen.

The Scottish Meteorological Society was founded in 1856, but though its early records give full particulars of the qualifications, appointment and withdrawal of several successive secretaries, curiously enough nothing is said in the published minutes of the appointment of Mr. A. Buchan, who read his first paper as Meteorological Secretary at the meeting of 11th April, 1861. The subject was "The cold weather of the previous Christmas." It is interesting to observe that even at this early period he treated the problem in a distinctly geographical manner, and he called attention to a fact, the importance of which he often referred to afterwards, the remarkable difference in the distribution of low temperatures according to the configuration of the surrounding land surface.

It was the custom for the Council of the Scottish Meteorological Society at that time, and for many years afterwards, to select a certain subject for investigation and report by the Meteorological Secretary, whose studies were thus guided by a body of learned and sagacious men of science and affairs. Guided in this way from 1861 onwards, Dr. Buchan was nearly as much the author as the

editor of the Journal of the Scottish Meteorological Society, the "new series" of which was started in 1862. It was the period of most rapid advance in meteorology, the principles of the synoptic weather chart, of the relation of wind direction to the isobars, and of scientific forecasts of the weather for short periods had just been enunciated, and thanks, in part to the early interest of Mr. D. Milne Home, of Milne Graden, in the Dutch weather forecasting experiments, and in part to the enthusiasm with which Buchan took the matter up in those early years, the name of Buys Ballot and the extension of the relation between barometric gradient and wind direction were soon thoroughly familiar in this country. In 1867 he published his "Handy Book of Meteorology," a second edition of which appeared in the following year. This book showed so firm a grasp of the principles of the science, and so thorough a mastery of observational detail, that it became the standard textbook in the language; and in later years many appeals were made to the author to bring it up to date. The increasing volume of official work and the burden of various important researches was such that the appeals had to be made in vain. Following on the larger work an "Introductory Textbook of Meteorology" was issued in 1871.

In 1869 Mr. Buchan read to the Royal Society of Edinburgh the paper by which his reputation as a leader in meteorology was established at once and for ever throughout the world. It dealt with the difficult and baffling problem of charting the mean distribution of atmospheric pressure and prevailing winds over the globe. This paper was perhaps the most fruitful, though it was far from being the most laborious piece of work which Dr. Buchan accomplished. A natural result was that on the return of the *Challenger* expedition in 1876, the vast mass of meteorological data accumulated in every part of the world was handed over to Dr. Buchan to report upon. He was able to prepare as the basis of his "Report on Atmospheric Circulation," published in 1889, maps of the world representing the mean temperature, and also the mean barometric pressure and wind directions for every month as well as for the year. These were prepared in pairs for each month, one map showing the whole world on a projection modified from Mercator's, the other showing the northern hemisphere down to about latitude 30° N., on a much larger scale. His last work on terrestrial meteorology was the editorship of the volume on Meteorology in Bartholomew's great "Physical Atlas," in which he was aided by Dr. A. J. Herbertson.

Climatology, that department of meteorology which is equally a department of geography, always claimed the lion's share of Dr. Buchan's attention. He worked as much with maps as with tables of figures, and it is to his patient labours that we are indebted for the first discussion of the monthly distribution of pressure and temperature over the British Isles. The subject frequently attracted

him in later years, and there are several valuable papers dealing with it in his "Journal."

The relation of climate to disease occupied his attention, and was dealt with in several papers written jointly with Sir Arthur Mitchell, one of the founders of the Scottish Meteorological Society.

In 1883 two important enterprises engaged the attention of Dr. Buchan and the other leading men interested in the study of natural phenomena in Edinburgh; one of these was the establishment of the Scottish Marine Station at Granton; and the other was the foundation of the observatory on the summit of Ben Nevis, and subsequently of a second observatory at Fort William. For the remainder of his life the meteorology of Ben Nevis unquestionably held the first place in Dr. Buchan's scientific work. He took his share in the efforts to awaken public interest and secure the necessary funds to start the observatories, and to carry them on, and he put forth more energy than was perhaps prudent from the point of view of health in the effort to persuade an indifferent Government to place the work on a permanent basis. Many references have been made in this Magazine to the unsuccessful struggle to secure public money for the maintenance of the Ben Nevis observatories, and we do not propose to dwell on it now. Dr. Buchan's old friend and colleague on Ben Nevis, Mr. R. T. Omond, has kindly sent a valuable note on the subject.

While Dr. Buchan was particularly associated throughout his long and active life with the scientific activity of Scotland, and of Edinburgh in particular, he was also well known in London, where he had a place on several important representative bodies. For many years he was the representative of the Royal Society of Edinburgh on the committee, nominated for the most part by the Royal Society of London, for the administration of the Government grant of £4000 per annum for scientific research. In 1887 he was appointed a member of the Meteorological Council, the body which, on the responsibility of the Royal Society of London, directed the Meteorological Office and administered the sum set apart by Parliament for the meteorological service of the country. He became a Fellow of the Royal Society in 1898. Dr. Buchan frequently attended the meetings of international committees, and was on terms of personal friendship with all the leading continental meteorologists.

When the Symons Memorial Gold Medal was founded, the Royal Meteorological Society made the first award to Dr. Buchan as the most eminent British meteorologist.

Dr. Buchan received the honorary degree of LL.D. from the University of Glasgow in 1887. He was a member of the Council of the Royal Society of Edinburgh for nearly forty years, and he received in turn the Makdougall Brisbane and the Gunning prizes of the Society. In connection with the Edinburgh Royal Society Club, Dr. Buchan shone in a sphere with which many to whom he was familiar in the streets and in his office never associated him,

as purveyor of intellectual gaiety of the old Scottish type. As a host Dr. Buchan was always charming, and his breakfasts on the occasion of such meetings as those of the British Association are not to be forgotten by any one who had the privilege of taking part in them. The first Meteorological Breakfast at the British Association was given by Mr. D. Milne Home in 1871, and the function was continued by Mr. Symons for several years. When we revived the Meteorological Breakfast at Glasgow in 1901 we were fortunate in securing Dr. Buchan as chairman, and on that occasion he gave a short speech full of the memories of the great exponents of meteorology who had graced those meetings in the past.

We cannot close these notes without a tribute to the memory of Miss Jessie Hill Buchan, the faithful niece and invaluable assistant who worked for so many years in the office with her uncle.

In private life Dr. Buchan was full of surprises to those who expect to find a student of science a man of one idea. He took a deep interest in church matters, and was an elder in Free St. George's. He revelled in poetry, especially in the old Scottish ballads, from which on suitable occasions he could produce singularly apt quotations, and his knowledge of literature was remarkable when one remembers the laborious and engrossing nature of his never-ceasing work.

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## DR. ALEXANDER BUCHAN AND THE BEN NEVIS OBSERVATORIES.

BY R. T. OMCND.

WHEN the Meteorological Observatory on Ben Nevis was established as a permanent station with resident observers in 1883, Dr. Buchan drew up the scheme of observations, which was adhered to throughout the whole time the Observatory was in existence as a scientific institution. With characteristic thoroughness he insisted on the necessity of a complete hourly record of the chief meteorological elements—such as pressure, temperature, wind, rainfall, etc.—even though it were necessary to get these by “eye” readings when self-recording instruments would not work. As the ever growing record of these observations came in, he dealt with them in the same systematic and masterly manner which in former years he had shown in his great discussions of the atmospheric pressures and temperatures of the world.

The foundation of this work was his comparison of the barometric pressure on the summit of Ben Nevis with that at sea level, first for general average values and then for individual hourly readings from day to day. This was quite a new method of treating high level observations, and has not I believe been carried out elsewhere except to some extent in respect to the high level stations in India. It is a

method which can only be used for fixed mountain stations; the barometric traces got from kites and balloons are useless for such a discussion because with them the exact height above sea level of the instrument recording the pressure is not known. He showed the intimate connection between pressure and temperature at the high and low level stations and how this varied with the weather conditions at the two places. Some of the results of his investigations are given in the appendices to the volumes of Ben Nevis observations in the Transactions of the Royal Society of Edinburgh, but these papers were only introductory; Dr. Buchan hoped to be able to develop this line of research further, but it was not so to be, and the future investigation of the Ben Nevis record must be carried on by others building on the foundations laid by Dr. Buchan.

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### THE TEMPERATURE OF JUNE, 1907.

It is possibly some small compensation for enduring so inclement a period as the past spring and early summer, that the meteorologist should experience the mild excitement afforded by the comparison of his observations with those of previous years, and entertain the reasonable expectation of being able to establish a new "record" to carry down into the future.

During the month of June the British Isles came under the influence of a series of shallow depressions advancing from the Atlantic in a north-easterly direction, and following one another in rapid succession. Except in the north of Scotland there was, in consequence, an unusual tendency towards westerly and south-westerly winds, which were constantly accompanied by cloudy skies and frequent rain. The temperature for the month was below the average everywhere in the United Kingdom, falling short on the whole by about  $2^{\circ}5$ . The deficiency increased fairly uniformly from east to west in Great Britain, exceeding  $3^{\circ}$  in the western half of Scotland, the whole of Wales, and many parts of the west of England. The most serious deficiencies occurred in the western Highlands and in the south of Wales, where the mean temperature was probably more than  $4^{\circ}$  in defect over considerable areas. Only in the extreme east of Great Britain and north of Scotland did the temperature rise to within  $2^{\circ}$  of the average, and several coast stations in Yorkshire and East Anglia approached to within  $1^{\circ}$  of the normal.

In Ireland the general temperature was about  $3^{\circ}$  below the average; the inland stations were comparatively less cold than the coast stations. At Killarney only was the deficiency less than  $2^{\circ}$ .

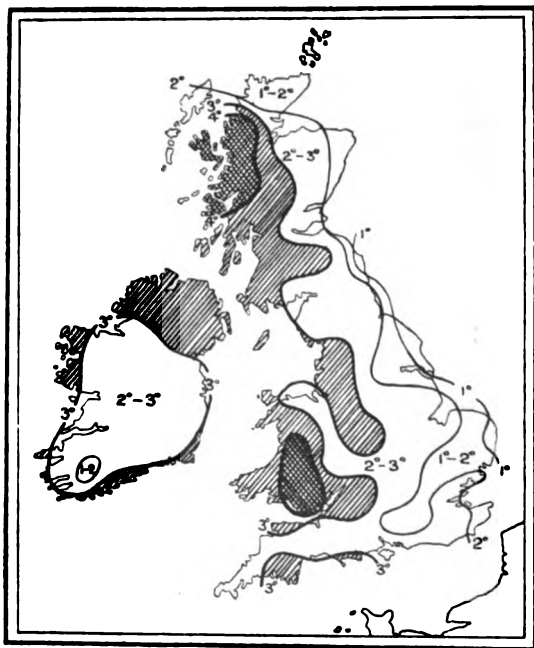
The map which is reproduced herewith shows by the increasingly dark shading the increasingly low temperatures in June, expressed by the number of degrees below the average for each locality.

During the first week practically no instances of shade maxima exceeding  $70^{\circ}$  were reported in the British Isles, and at a large



majority of stations the average maximum failed to reach  $60^{\circ}$ . The minima were on the whole less remarkable, and only fell below  $40^{\circ}$  in Scotland and a few stations in the north of England. The temperature was normal or slightly above the average during the second week, but the day temperatures were in most places remarkably moderate. The last fortnight was everywhere extremely cold, with no maxima exceeding  $70^{\circ}$ , and a considerable number of instances of ground frost. The lowest shade minimum reported was  $32^{\circ}$  at Balmoral.

TEMPERATURE OF JUNE, 1907.  
NUMBER OF DEGREES BELOW THE AVERAGE.



*The shaded area had a deficiency of more than  $3^{\circ}$ , the cross shaded area more than  $4^{\circ}$ .*

The temperature conditions in London, although sufficiently noteworthy to call for comment, were less severe than in most parts of the Kingdom, and the table below of the readings at Camden Square shows that the mean temperature has been lower in June on 6 occasions during the past half century. It should be noted that the extremes quoted for the Glaisher screen are not strictly comparable with observations taken in the standard Stevenson screen in use at

the majority of observing stations. The readings in the Stevenson screen are therefore added, but the Glaisher screen readings alone are compared with averages.

*Temperature at Camden Square, June, 1907.*

|                                      | June, 1907. | Difference<br>from Aver.,<br>1858-1897. | Number of<br>times lower,<br>1858-1906. |
|--------------------------------------|-------------|-----------------------------------------|-----------------------------------------|
| Mean Shade Max. ....(Glaisher)...    | 67·0        | —4·3                                    | 3                                       |
| " " Min. ....(Stevenson)             | 65·9        | ...                                     | ...                                     |
| " " Min. ....(Glaisher)...           | 50·4        | —0·5                                    | 17                                      |
| " " Temp. ....(Stevenson)            | 51·5        | ...                                     | ...                                     |
| " " Temp. ....(Glaisher)...          | 58·0        | —2·4                                    | 6                                       |
| Extreme Shade Max. ....( " )...      | 78·0        | —5·1                                    | 7                                       |
| " " Min. ....(Stevenson)             | 75·6        | ...                                     | ...                                     |
| " " Min. ....(Glaisher)...           | 43·9        | +2·1                                    | 40                                      |
| " " Sun Max. (black) ....(Stevenson) | 45·2        | ...                                     | ...                                     |
| " Sun Max. (black) .....             | 123·8       | —5·7                                    | ...                                     |
| " Grass Min. ....                    | 39·9        | +3·1                                    | ...                                     |

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THE DINNER OF THE ROYAL METEOROLOGICAL SOCIETY.

THE annual dinner of the Society was held in the Trocadero Restaurant, on the evening of Tuesday, 18th June, Dr. H. R. Mill, President, in the chair. There were present about ninety gentlemen, including a number of distinguished guests. The company included the Norwegian Minister, Dr. Fridtjof Nansen, the Right Hon. Sir George Taubman Goldie, President of the Royal Geographical Society, Sir Richard Douglas Powell, Bart., President of the Royal College of Physicians, Sir Richard Biddulph Martin, Bart., Prime Warden of the Fishmongers' Company, Sir Norman Lockyer, K.C.B., Sir Thomas Elliott, K.C.B., Secretary to the Board of Agriculture, Sir John Murray, K.C.B., Sir Lauder Brunton, Professor Otto Pettersson, of Stockholm, Hon. W. Pember Reeves, High Commissioner for New Zealand, Professor J. Perry, Mr. E. H. Shackleton of the British Antarctic Expedition, Dr. J. Scott Keltie, Mr. J. Wrench Towse, Mr. Günther, Mr. A. Watt, Secretary of the Scottish Meteorological Society, Mr. R. A. Gregory, Dr. C. Theodore Williams, Mr. F. Campbell Bayard, Mr. H. Mellish, Dr. R. H. Scott, Captain D. Wilson-Barker, Mr. Richard Bentley, Mr. W. Ellis, Dr. W. N. Shaw, Captain Campbell Hepworth, Mr. D. W. Freshfield, Mr. Baldwin Latham, Mr. F. Druce, Rev. H. A. Boys, Major B. Baden-Powell, Rev. Wm. Esdaile, Mr. R. G. K. Lempfert, Mr. J. A. Curtis, Mr. R. H. Curtis, Captain Clarke, Mr. R. Inwards, Mr. Harries, and Mr. W. Marriott.

During the evening songs of appropriate character were interspersed with the speeches, the musical arrangements being under the personal direction of Mr. H. Schartau. Amongst the songs were "The Stormy Winds do Blow," "The Rain it raineth every day," "Haste ye Soft Winds to my relief," and "The long day closeth." A flash-light photograph was taken in the course of the evening.

After the Royal toasts had been honoured, Dr. Nansen proposed "The Royal Meteorological Society," in an eloquent speech, in which he laid stress on the lofty ideal which should be kept in view by every scientific society, the pursuit of knowledge for its own sake, irrespective of its immediate utility. The Chairman, in responding, said that the Society was prosperous and growing in numbers, harmonious in its domestic relations between Fellows and Council, and fraternally disposed towards co-operation with all other bodies pursuing kindred studies. While the main aim of the Society was always the advancement of the science of meteorology, the humbler needs of the applications of the science to the affairs of the fisherman, farmer, and the general public, were not ignored.

Dr. C. Theodore Williams, Treasurer of the Society, proposed "Kindred Institutions," referring to the large number of interests with which meteorology came in contact. Sir George Goldie replied on behalf of other learned societies, dwelling on the close kinship between meteorology and geography. Dr. W. N. Shaw, Director of the Meteorological Office, replied on behalf of official meteorologists. He paid a graceful tribute to the services to science of the late Dr. Buchan, and to the fruitful labours of such veteran workers as Sir Richard Strachey and Mr. Francis Galton, and he did not forget the great army of volunteer observers who accumulate the data for specialists to study.

Mr. Richard Bentley proposed "The Visitors," referring to the wide range of the Earth from which they had come, from the close neighbourhood of the north pole and of the south, and to the vast variety of the interests—all kindred to the science of the weather—which they represented. Sir John Murray, of the *Challenger* expedition, and Sir Thomas Elliott, replied, the latter expressing the keen appreciation of the relation between meteorology and agriculture felt by the Board of Agriculture and Fisheries.

The toast of "The Chairman," proposed by Mr. F. Campbell Bayard, and briefly acknowledged, terminated the proceedings.

It was felt generally that the dinner had passed off pleasantly, and the distinguished visitors being scattered amongst the Fellows and not concentrated together, as is not unusual on such occasions, the body of the Fellows present was able to play its part of host, and to enjoy to the full the society of the guests.

Correspondence.

*To the Editor of Symons's Meteorological Magazine.***SUMMER SNOW AND FROST: CLIMATIC VAGARIES.**

COL. CHRYSTIE'S note of snow on June 3rd, at Farnham, Surrey, reminds us of some past experiences suggesting that there is no month of the year in which snow and frost are not possible in England.

On July 11th, 1888, in the early morning a few flakes of snow fell at Bristol, and the newspapers stated that on the same morning at Shepton Mallet, Somerset, the ponds were covered with a thin coating of ice! For the day named I recorded a mean temperature of 49° , the minimum at 4 ft. being $40^{\circ}5$ and there was a slight grass frost.

In the Registrar General's Reports snow was stated to have fallen heavily in 1888 on the night of June 10th, in Scotland, the depth being 6 inches. On July 10th snow was observed at Keswick, and on July 11th snow showers occurred in north and east Derbyshire where the weather was so bad that the harvest had to be suspended.

During the very inclement summer of 1879, snow fell on July 4th and 8th at Bolton and on July 9th at Cockermouth. In 1883, on July 15th snow fell at Whitchurch; other instances might be quoted.

Looking back through my old meteorological records I find some interesting evidence as to the vagaries of our climate. Thus on July 14th, 1876 and July 11th, 1888, I registered mean temperatures of $50^{\circ}6$ and $49^{\circ}0$, whereas on December 28th, 1876 and December 6th, 1889, I obtained $55^{\circ}0$ and $54^{\circ}9$.

The great heat of the summer of 1876 was terminated on Saturday, August 19th, by very heavy thunderstorms which occurred during the afternoon and night. At 9 a.m. on August 20th I measured 3.570 inches of rain in my gauge. Yet, after the intense heat of previous weeks there was a slight frost on the grass here on the early morning of August 25th in some situations, though my terrestrial radiation thermometer did not fall below $32^{\circ}6$.

At Ashley Down, Bristol, where nearly all my observations were taken, I found May frosts, often very severe. Thus on May 5th, 1877, the shade minimum was $26^{\circ}8$, and the grass minimum $20^{\circ}4$.

On March 19th, 1867, and March 15th, 1887, snow lay on the ground here to the depths of 13 and 16 inches respectively. Yet March 16th, 1884 was a perfectly summerlike day, with a maximum temperature of 67° .

W. F. DENNING, F.R.A.S.

Bishopston, Bristol, June 19th, 1907.

P.S.—The *Daily Mail* of June 27th contained the following:—

"There was the unique experience last evening, June 26th, of a snow and hail storm of nearly an hour's duration on the eastern range of the Lammermoor Hills, which for a short time were almost totally mantled in white."—W. F. D.

RAPID FORMATION OF FOG AND GLOOM.

I SUSPECT that a bank of London smoke was the cause of the phenomenon described on p. 53. I have several times seen the same phenomenon here when the wind has been from the direction of London, though this place is 36 miles off as against Epsom's 16.

ALFRED O. WALKER.

Ulcombe Place, 17th April, 1907.

THE DRY FIRST QUARTER OF 1907.

IN an unbroken period of 21 years of meteorological work here, I have had no precedent of such a dry three months as January, February and March; rain only falling on 28 days out of the 90, with a total of 3·16 in., being a little below the half of the average amount. This is true even though February, 1890, had only rain on 6 days, and February, 1891, none at all. W. G. MACHIN.

Hartley Wintney.

MAXIMUM AND MINIMUM TEMPERATURES.

THE kind of difficulty mentioned by Mr. H. E. Wood, p. 72, in your May issue, is, I consider, a still greater one as regards the minimum temperature. I think the maximum temperature ought to be recorded somewhere about the usual time of minimum, and the minimum somewhere about the usual time of maximum. The general practice with regard to the maximum is sufficiently near this; but many observers record the minimum at 8 or 9 a.m., which in winter in this country is not far from the usual time of minimum, the result being that one minimum is often recorded twice over, which seems unfair. 1 or 2 p.m. would be much fairer for recording the minimum.

T. W. BACKHOUSE.

West Hendon House, Sunderland, 8th July, 1907.

MARCH AND JUNE.

IT may be of interest to note that on March 31st I recorded a maximum reading of 70°·1, the highest in March in my 24 years' record, and apparently the highest recorded in London for 50 years.

The temperature in the month of June just past has only risen to 70° on one day. The absolute maximum (74°·9) and the mean maximum (64°·4) are both the lowest yet recorded here in 24 years, though the mean temperature was a trifle lower in 1903.

The great thunderstorm on the 29th, when 1·22 in. was measured, raised the total rainfall to 2·92 in., otherwise it would have been under average, in spite of the dull and showery weather that has prevailed.

G. VON U. SEARLE.

30, Edith Road, West Kensington, W., 6th July, 1907.

THE INTERMITTENT SUNSHINE OF JUNE, 1907.

It may possibly be of interest to observe, as characteristic of the month just past, that the total sunshine measured here in June, 170 hours 42 minutes (about 25 hours less than the average), was recorded in upwards of three hundred *separate* traces. There are indications of a still larger number, but those traces which impinge on each other without a distinct interval have not been taken into account. The measurement was by the Campbell-Stokes recorder.

RICHARD BENTLEY.

Upton, Slough, Bucks, July 1st, 1907.

THE COLD JUNE OF 1907.

THE wettest and coldest June I can remember has just come to an end with 5·42 in. of rain falling on 25 days. The heaviest fall was ·84 in. on the 22nd, with thunder and hail. The maximum shade temperature was 65° on the 8th, 11th and 17th; the minimum 39° on the 25th. The thermometer reached 60° on only 15 days. Thunder occurred on the 10th, 12th, 22nd and 28th. The prevailing direction of the wind was S.W. to S.E.

HENRY B. MURRAY.

Arlnareigh, Antrim, July 1st, 1907.

A FEW facts about the weather experienced at Buxton, the highest meteorological station in England, during June, 1907, might be of interest to observers at stations of lower altitude.

The rainfall amounted to 8·10 in., and is the second highest on record, being only exceeded by the fall in 1882, which amounted to 8·42 in. The average rainfall for June is 3·42 in., so that this year's fall is more than double the average. Rain fell on no fewer than 27 days, this constituting a new record; the previous one being 25 days, in June, 1879.

The total duration of bright sunshine, as registered by a Jordan Sunshine Recorder, was 133·2 hours—38·2 hours below the average. During the month five days had no sunshine whatever, and five had under an hour.

The mean temperature was 3°·6 below the average, being 51°·0. The maximum temperature for the month was registered on the 9th, 69°·1, and, with the exception of June 20th, 1879, is the lowest maximum temperature for the month ever experienced in June. Freezing point was not reached once, either in the screen or on the ground.

Severe thunderstorms occurred on the 5th and 9th and thunder alone was heard on the 30th.

FREDK. T. KEILDSSEN, JUN.

Lismore House, Buxton, Derbyshire, July 2nd, 1907.

THE following table gives particulars of rainfall and temperature from the writer's observations for the month of June at Belper, Derbyshire, where the rainfall during the 30 years, 1877-1906, exceeded that of June, 1907, on eight occasions :—

	Rainfall in June. in.	Total from Jan. 1—June 30. in.	No. of Rain Days.	TEMPERATURE.		
				Mean max.	Mean min.	Mean.
1879	6·21	19·24	25	62·3	49·0	53·6
1892	5·09	14·31	18	63·3	47·0	55·2
1891	4·82	15·26	12	64·4	49·4	56·9
1900	4·49	18·31	17	66·3	50·3	58·3
1882	4·13	18·42	19	62·1	47·0	54·6
1883	3·91	15·16	14	63·9	48·0	56·0
1897	3·82	17·91	12	66·8	50·9	58·8
1880	3·58	12·47	17	63·0	48·0	55·5
1907	3·42	14·24	22	60·8	47·6	54·2

Comparison of the Actual Records for June, 1907, with the Means for 30 Years, 1877—1906 :—

	June, Mean 30 years, 1877-1906.	June, 1907.
Rainfall, inches	2·56	3·42
Rain from Jan. 1—June 30	14·10	14·24
Days on which rain fell.....	13	22
Mean temp.	57°·0	54°·2

JOHN HUNTER, A.M.I.C.E., F.R.Met.Soc.

Belper, July 1st, 1907.

TEN "SUMMER" DAYS.

THE ten days ending July 8th, 1907, give the following average temperatures :

9 a.m. temp.....	53°·6	Max. in Stevenson screen..	57°·4
(Grass thermometer	38°·0	Min. " " " " ..	42°·3
One foot below the surface..	52°·7	Mean " " " " ..	49°·8
Two feet " " " " ..	52°·2	Rainfall, 1·05 inches on 8 days.	

This is by far the most arctic weather we have experienced here in summer since my register began in 1878 ; I have taken out the ten individually coldest days that have occurred in July since that year, and find the mean 49°·5, or only 0°·3 lower than the ten *consecutive* days just passed.

The mean temperature of June, 1907, is less (53°·2) than any year during the same period, while the number of rain days (25) is the greatest, though the rainfall has twice been slightly exceeded.

For the quarter ending June we have had 70 rain days out of 91, with 13·39 inches of rain, an excess of 59 per cent. above the average ; also unequalled for a quarter of a century.

CHARLES L. BROOK.

Harewood Lodge, Meltham, July 10th, 1907.

THE RELATION BETWEEN THE WEATHER OF SPRING AND OF THE FOLLOWING SUMMER.

It is a familiar saying that "a bushel of March dust is worth a king's ransom." The meaning apparently is that with a dry March we may expect a bountiful season. Such a season generally implies, I suppose, a fine, hot summer. We may then usefully compare March, wet or dry (rainfall over or under average), with the heat of the following summer. This heat may be measured by the number of "hot days," or days with a maximum of 80° or more. Of these there are 15 in the year on an average at Greenwich, and the numbers have ranged from 0 up to 40. We take the 66 years, 1841—1906.

It appears that a dry March is followed about equally often by a hot and by a cool summer. But on comparing the hot summers after dry Marches with those after wet Marches, the former are seen to be both more numerous (19 to 9), and to run oftener into higher figures. Consider these two facts :—

1. The five hottest summers of all (hot days in each case over 28) were each preceded by a dry March.

2. Of the 19 hottest summers (20 to 40 hot days), 16 were preceded by a dry March.

I may say that 17 of these 19 were also dry. (In our summers heat and dryness generally go together; in winters, heat and wet. Spring and autumn, being transitional, seem to be neutral in this respect.)

May not a perception of some such relations as the above have been at the genesis of the practical saw about March dust?

The relations of spring and summer are variously interesting. Thus, a cold and wet spring is rarely followed by a hot summer. I find that out of 14 such springs, only 2 were so followed; the hot days then numbering 21 and 17 respectively (average 15). The opposite case (of warm and dry springs) is less pronounced, and the two remaining possible cases seem to be neutral.

With a spring rainfall of 6 inches or more (average 5.1 in.), the prospect of a hot summer would appear to be extremely small.

The seasonal conditions of a good wheat harvest are being ably elucidated by Dr. Shaw. In a recent paper to the *Journal of Agricultural Science* (January, 1907), dealing with 22 years' experience in east England, he considers (from average results) that "a good wheat yield is preceded by a dry and warm autumn, a rather dry and warm winter, a rather wet and cold spring, and a dry and slightly warm summer."

ALEX. B. MACDOWALL.

REVIEWS.

Gesammelte Abhandlungen aus den Gebieten der Meteorologie und des Erdmagnetismus von WILHELM VON BEZOLD. In Gemeinschaft mit A. COYM herausgegeben vom Verfasser. Mit 66 Abbildungen im Text und 3 Tafeln. [Collected Memoirs relating to Meteorology and Terrestrial Magnetism, by WILHELM VON BEZOLD. Edited by the Author with the co-operation of A. COYM.] Braunschweig: Friedrich Vieweg und Sohn. 1906. Size 10 × 7. Pp. viii. + 448.

THE last work of the author was the preparation of what is always the best memorial of a man of science—a selection of his best work gathered in from the scattered media of publication, revised and where necessary supplemented by his own hand. To the student it is no small advantage to have between two boards, or, to be exact, between paper covers, a set of memoirs which would otherwise have to be sought for individually through many volumes of Transactions all of which are to be found only in a very few libraries. Indeed, the author allows in his preface that he acceded to the request of the publishers largely because his more strictly scientific works were so difficult of access that they were scarcely known except in the form of inadequate abstracts.

There are altogether twenty papers reproduced in the volume, sixteen relating to meteorology and four to terrestrial magnetism. The former, with dates of publication and number of pages are:—

Observations on Twilight. (1864, pp. 34).

On regular variations in the frequency of thunderstorms. (1874, pp. 25).

On an approximately 26-day periodicity in thunderstorms. (1888, pp. 11).

On the increase in the danger from lightning during the last 60 years. (1899, pp. 12, with supplement, 1906, pp. 8).

On the Thermodynamics of the Atmosphere. Part I. (1888, pp. 37).

Ditto. Part II. Potential Temperature. Vertical Temperature Gradient. Compound Convection. (1888, pp. 17).

Ditto. Part III. Mixing of Air. Formation of Cloud and Precipitation. (1890, pp. 39).

Ditto. Part IV. Supersaturation and Over-cooling. Thunderstorm formation. (1892, pp. 32).

Ditto. Part V. The climatological importance of the study of ascending and descending air-currents. (1900, pp. 5).

Theoretical considerations on the results of scientific ballooning. . . . (1900, pp. 44).

On the working up of the humidity data obtained by balloons. 1894, pp. 9).

On the temperature changes in ascending and descending air-currents. (1898, pp. 10).

On the Theory of Cyclones. (1890, pp. 22).

On the representation of pressure distribution by pressure surfaces and by isobars (1901, pp. 10).

The exchange of heat on the Earth's surface and in the atmosphere. (1892, pp. 41).

On climatological means for whole parallels of latitude. (1901, pp. 14).

METEOROLOGICAL NEWS AND NOTES.

A SPECIAL ASSISTANT is required in the Meteorological Office whose duties will be mainly with scientific investigation. He will be expected, in the first instance, to carry out investigations with reference to forecasts of weather, and he must be prepared to attend at the Office from the morning hours of observation at the reporting stations (8 a.m. or possibly 7 a.m.) when required. He will also be called upon for some secretarial work, and for assistance as regards University lectures, or in other ways at the Director's discretion. The appointment will date from October 1st, 1907, and will be in the first instance, for a year on probation at a salary of £250. An adequate knowledge of physics (theoretical and experimental) as well as of mathematics is essential. Applications, with references, should be addressed to the Director, Meteorological Office, 63, Victoria Street, S.W.

PROFESSOR W. J. VAN BEBBER has, we are informed, retired from his position as Departmental Head in the Deutsche Seewarte at Hamburg.

THE INTERNATIONAL COUNCIL FOR THE STUDY OF THE SEA met this year in London, during the week from June 9th to 15th. The meetings of the constituent committees took place in the rooms of the Royal and Linnean Societies; the formal meetings of the Council were in the Foreign Office. It was decided to carry on the international co-operation for one year more, to July, 1908, and to prepare a comprehensive report on the hydrographical, biological and statistical work accomplished in the five years of the Council's activity. His Majesty the King received the Council and experts at Buckingham Palace, on the afternoon of the 14th. Lord Carrington, President of the Board of Agriculture and Fisheries, and Mr. Sinclair, Secretary for Scotland, gave dinners, and so did the Lord Mayor, the Worshipful Company of Fishmongers, and the Royal Geographical Society and Geographical Club. On the 15th Dr. and Mrs. H. R. Mill gave a garden party, with some novel features, at Mill Hill, and the meeting terminated with a lunch in Christ's College, Cambridge, at the invitation of Mr. A. E. Shipley, Chairman of the Council of the Marine Biological Association.

A NOVELIST'S OBSERVATION on rainfall measurement was brought to our notice the other day by a German professor whose habits of wide reading lead him far beyond his native language. The reference is to Anthony Hope's "Dolly Dialogues":—

"By Jove!" remarked Archie, coming up behind us, pipe in mouth, "there was a lot of rain last night. I've just measured it in the gauge."

"Some people measure everything," said I, with a displeased air. "It is a detestable habit."

TEMPERATURE FOR JUNE, 1907.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				No. of Nights at or below 32°	
					Max.		Min.		Shade.	Grass.
					°	Date.	°	Date.		
Camden Square.....	London.....	51 32	0 8	111	78·0	9	43·9	17	0	0
Tenterden.....	Kent.....	51 4	0 41	190	73·5	9	41·5	17	0	0
West Dean.....	Hampshire.....	51 3	1 38	137	76·0	17	41·0	17, 30	0	...
Hartley Wintney.....	".....	51 18	0 53	222	74·0	9†	38·0	17||	0	...
Hitchin.....	Hertfordshire.....	51 57	0 17	238	...	...	...	...	...	...
Winslow (Addington).....	Buckinghamsh.	51 58	0 53	309	74·0	9	42·0	17†	0	0
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	0 40	226	73·0	9	39·5	17	0	...
Brundall.....	Norfolk.....	52 37	* 1 26	66	73·8	9	44·0	7	0	0
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	...	...	...	...	...	...
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	64·9	16	45·0	29	0	0
Polapit Tamar [Launceston].....	".....	50 40	4 22	315	63·9	4	37·5	29	0	0
Bath.....	Somerset.....	51 23	2 21	67	73·0	9	43·0	29	0	...
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	73·0	9	46·0	2	0	...
Church Stretton (Woolstaston).....	Shropshire.....	52 35	2 48	800	71·5	9	32·0	3	1	...
Coventry Kingswood.....	Warwickshire.....	1 30	52 24	340	73·0	9	42·0	2	0	...
Boston.....	Lincolnshire.....	52 58	0 1	25	75·0	9	46·0	3	0	0
Worksop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	74·6	9	39·1	30	0	2
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	...	...	...	...	...	...
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	73·9	9	40·6	25	0	0
Wetherby (Ribston Hall).....	Yorkshire, W.R.	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage.....	".....	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park).....	" E.R.	53 45	0 20	6	71·0	9	40·0	4	0	...
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	71·6	9	40·3	29	0	...
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street).....	Pembroke.....	51 48	4 58	95	65·1	...	40·0	...	0	...
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	76·0	5	35·0	28	0	...
Llandudno.....	Carnarvon.....	53 20	3 50	72	75·0	9	44·0	30	0	...
Cargen [Dumfries].....	Kirkcudbright.....	55 2	3 37	80	71·0	9	39·0	30	0	...
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	...	...	...	...	...	...
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	64·2	17	39·7	4	0	0
Girvan (Pinmore).....	Ayr.....	4 49	55 10	207	66·0	30	36·0	30	0	...
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	63·0	10	39·0	24	0	3
Tighnabruaich.....	Argyll.....	55 55	5 14	50	60·0	17, 29	36·0	24	0	...
Mull (Quinish).....	".....	56 36	6 13	35	70·0	17	...	...	...	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	71·8	17	35·0	4	0	...
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford).....	".....	57 8	2 7	120	63·0	8†	36·0	3, 24	0	...
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	13c†	...	...	...	...	...	...
Loch Torridon (Bendamph).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	63·0	11	37·5	4	0	...
Castletown.....	Caithness.....	58 35	3 23	100	70·0	9	36·0	19	0	0
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	66·0	8, 20	40·0	17	0	...
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	64·5	26	...	...	...	...
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	66·0	78	41·0	30	0	...
Abbey Leix (Blandsfort).....	Queen's County.....	52 56	7 17	532	66·6	7, 17	...	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	65·2	14	43·0	25	0	0
Ballinasloe.....	Galway.....	53 20	8 15	160	72·0	13	36·0	29, 30	0	...
Clifden (Kylmore House).....	".....	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...	...
Seaforde.....	Down.....	54 19	5 50	180	72·0	12	39·0	3	0	...
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	...	...	...	...	...	...

† and 10, 11.

‡ and 19, 27, 28.

§ and 11 14.

¶ and 29, 31.

* and 29, 30.

RAINFALL FOR JUNE, 1907.

RAINFALL OF MONTH.						RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.	
Aver. 1870-99.	1907.	Diff. from Av. in.	% of Av.	Max. in 24 hours.	No. of Days	Aver. 1870-99.	1907.	Diff. from Av. in.	% of Av.			
in.	in.			in. Date.		in.	in.			in.		
2'09	2'03	— '06	97	'46	1	19	10'63	10'04	— '59	94	25'16	Camden Square
1'96	1'69	— '27	86	'28	11	14	11'55	10'16	— 1'39	88	28'36	Tenterden
2'02	1'23	— '79	61	'35	12	17	12'61	10'75	— 1'86	85	29'93	West Dean
1'89	2'25	+ '36	119	'61	5	18	11'59	11'48	— '11	99	27'10	Hartley Wintney
1'89	2'03	+ '14	107	'39	30	20	10'26	11'00	+ '74	107	24'66	Hitchin
1'99	2'29	+ '30	115	'70	1	22	11'28	11'12	— '16	99	26'75	Addington
2'04	2'00	— '04	98	'26	6	18	10'32	12'21	+ 1'89	118	25'39	Westley
1'89	2'91	+ 1'02	154	'51	1	16	10'12	13'57	+ 3'45	134	25'40	Brundall
2'32	2'96	+ '64	128	'61	11	20	16'36	14'91	— 1'45	91	39'00	Winterbourne Stptn
2'13	1'65	— '48	77	'50	11	18	15'05	13'20	— 1'85	88	35'00	Torquay
2'12	2'43	+ '31	115	'48	11	25	15'45	15'71	+ '26	102	38'85	Polapit Tamar
2'31	2'39	+ '08	103	'41	24	23	13'03	12'12	— '91	93	30'75	Bath
2'23	2'73	+ '50	122	'61	10	20	12'83	11'35	— 1'48	88	29'85	Stroud
2'46	4'13	+ 1'67	168	'45	5	22	14'31	14'86	+ '55	104	33'04	Woolstaston
2'41	2'41	— '00	100	'59	11	21	12'56	12'14	— '42	97	29'21	Coventry
1'94	1'50	— '44	77	'25	24	13	9'76	9'59	— '17	98	23'30	Boston
2'24	2'16	— '08	96	'53	11	21	10'81	10'37	— '44	96	24'70	Hodsock Priory
2'70	3'25	+ '55	120	'42	30	24	11'48	13'11	+ 1'63	114	26'18	Derby
3'21	7'84	+ 4'63	245	1'11	5	28	16'75	22'74	+ 5'99	136	42'43	Bolton
2'38	3'07	+ '69	129	'55	11	23	11'63	13'06	+ 1'43	112	26'96	Ribston Hall
3'69	7'72	+ 4'03	209	'85	5	27	26'47	33'06	+ 6'59	125	60'96	Arncliffe Vic.
2'12	3'02	+ '90	143	'84	15	20	11'24	12'30	+ 1'06	109	27'02	Hull
2'03	2'19	+ '16	108	'39	20	20	11'35	11'94	+ '59	105	27'99	Newcastle
6'97	17'04	+ 10'07	244	1'99	4	29	57'36	63'18	+ 5'82	110	132'68	Seathwaite
2'53	3'91	+ 1'38	155	'38	10	24	17'19	16'80	— '39	98	42'81	Cardiff
2'61	4'87	+ 2'26	187	1'28	4	25	19'67	18'92	— '75	96	47'88	Haverfordwest
2'93	6'20	+ 3'27	212	'70	24	25	17'59	21'05	+ 3'46	120	45'41	Goggerdan
2'00	2'90	+ '90	145	'33	20	23	12'18	10'56	— 1'62	87	30'98	Llandudno
2'68	6'66	+ 3'98	249	'91	4	24	18'75	24'29	+ 5'54	130	43'43	Cargen
2'44	...	...	...	...	...	...	13'88	...	...	...	33'04	Riddell House
...	2'41	...	...	'39	9	21	...	10'15	...	...	...	Edinburgh
2'95	6'75	+ 3'80	229	1'41	4	28	20'52	...	...	...	48'87	Girvan
2'70	4'04	+ 1'34	150	'58	30	24	14'94	18'98	+ 4'04	127	35'80	Glasgow
3'76	6'02	+ 2'26	160	'67	26	25	24'65	28'77	+ 4'12	117	57'90	Tighnabruaich
3'55	3'48	— '07	98	'41	23	28	23'84	24'93	+ 1'09	105	57'53	Quinish
2'15	4'20	+ 2'05	195	'60	12	26	12'09	14'00	+ 1'91	116	28'95	Dundee
2'44	2'69	+ '25	110	...	...	...	14'94	15'80	+ '86	106	36'07	Braemar
2'09	3'72	+ 1'63	178	'43	12	22	13'69	14'96	+ 1'27	109	33'01	Aberdeen
2'24	4'52	+ 2'28	202	1'10	1	20	11'92	15'47	+ 3'55	130	29'37	Cawdor
2'85	4'84	+ 1'99	170	'75	26	18	24'72	31'62	+ 6'90	128	56'00	Invergarry
4'78	9'41	+ 4'63	197	1'02	19	30	36'04	50'26	+ 14'22	140	86'50	Bendamph
2'14	4'89	+ 2'75	228	'68	1,24	19	13'45	18'54	+ 5'09	138	31'60	Dunrobin Castle
...	3'96	...	...	'58	24	25	...	16'86	...	...	...	Castletown
3'29	3'21	— '08	98	'44	25	26	25'99	18'98	— 7'01	73	58'11	Killarney
2'61	4'36	+ 1'75	167	'62	4	23	17'19	15'58	— 1'61	91	39'30	Waterford
2'52	3'65	+ 1'13	145	'43	29	27	14'12	16'10	+ 1'98	114	33'47	Hurdlestown
2'43	3'63	+ 1'20	149	'35	8	26	15'20	15'67	+ '47	103	35'19	Abbey Leix
1'95	2'84	+ '89	146	'50	4	27	11'88	12'33	+ '45	104	27'75	Dublin
2'69	4'21	+ 1'52	157	'73	4	26	15'92	17'76	+ 1'84	112	37'04	Ballinasloe
5'33	6'33	+ 1'00	119	'77	20	26	34'29	31'03	— 3'26	90	80'23	Kylemore House
2'95	5'60	+ 2'65	190	'75	19	28	21'74	26'13	+ 4'39	120	50'50	Ennisceoe
2'72	5'63	+ 2'91	207	1'09	22	26	16'92	20'62	+ 3'70	122	38'61	Seaford
2'92	5'31	+ 2'39	182	'56	8	28	17'07	25'90	+ 8'83	152	41'20	Londonderry
2'88	...	...	...	...	...	...	15'86	...	...	...	37'85	Omagh

SUPPLEMENTARY RAINFALL, JUNE, 1907.

Div.	STATION.	Rain inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	2.14	XI.	Rhayader, Tyrmynydd	5.00
"	Ramsgate	1.22	"	Lake Vyrnwy	7.82
"	Hailsham	2.30	"	Llangyhanfal, Plas Draw	2.46
"	Crowborough, Uckfield Lodge	3.04	"	Criccieth, Talarvor	4.71
"	Totland Bay, Aston House	1.35	"	Llanberis, Pen-y-pass	20.90
"	Emsworth, Redlands	2.61	"	Lligwy	4.72
"	Alton, Ashdell	2.93	"	Douglas, Woodville	4.71
"	Newbury, Welford Park	3.80	XII.	Stoneykirk, Ardwell House	5.74
III.	Harrow Weald, Hill House	2.10	"	Dalry, The Old Garroch	5.91
"	Oxford, Magdalen College	2.94	"	Langholm, Grove Road	7.68
"	Bloxham Grove	2.73	"	Moniaive, Maxwellton House	5.01
"	Pitaford, Sedgebrook	2.18	XIII.	N. Esk Reservoir [Penicuik]	3.45
"	Huntingdon, Brampton	1.44	XIV.	Maybole, Knockdon Farm	3.76
"	Wisbech, Bank House	1.44	XV.	Campbeltown, Witchburn	4.34
IV.	Southend Water Works	1.80	"	Inveraray, Newtown	6.46
"	Colchester, Lexden	1.77	"	Ballachulish House	7.33
"	Newport, The Vicarage	1.82	"	Islay, Eallabus	4.22
"	Rendlesham	1.96	XVI.	Dollar Academy	6.27
"	Swaffham	2.27	"	Loch Leven Sluice	5.14
"	Blakeney	1.86	"	Balquhider, Stronvar	6.64
V.	Bishops Cannings	2.59	"	Perth, Pitculen House	4.66
"	Ashburton, Druid House	3.71	"	Coupar Angus Station	3.75
"	Okehampton, Oaklands	3.88	"	Blair Atholl	3.25
"	Hartland Abbey	3.01	"	Montrose, Sunnyside Asylum	4.56
"	Lynmouth, Rock House	3.47	XVII.	Alford, Lyturk Manse	3.96
"	Probus, Lamellyn	2.97	"	Keith Station	6.56
"	Wellington, The Avenue	2.24	XVIII.	N. Uist, Lochmaddy	3.99
"	North Cadbury Rectory	2.36	"	Alvey Manse	3.27
VI.	Clifton, Pembroke Road	3.23	"	Loch Ness, Drumnadrochit	4.08
"	Ross, The Graig	2.13	"	Glencarron Lodge	7.03
"	Shifnal, Hatton Grange	2.71	"	Fearn, Lower Pitkerrie	3.10
"	Cheadle, The Heath House	4.17	XIX.	Invershin	3.11
"	Blockley, Upton Wold	2.97	"	Altnaharra	3.53
"	Worcester, Boughton Park	2.38	"	Bettyhill	3.56
VII.	Market Overton	2.35	XX.	Dunmanway, The Rectory	5.90
"	Market Rasen	3.01	"	Cork	3.53
"	Hawtry, Hesley Hall	...	"	Darrynane Abbey	4.64
VIII.	Newton, Hinderton Lodge	3.04	"	Glenam [Clonmel]	3.88
"	Southport, Hesketh Park	5.92	"	Ballingarry, Gurteen	3.19
"	Chathburn, Middlewood	8.10	"	Milltown Malbay	4.02
"	Cartmel, Flookburgh	8.32	XXI.	Gorey, Courtown House	4.04
IX.	Langsett Moor, Up. Midhope	6.27	"	Moynalty, Westland	4.72
"	Scarborough, Scalby	3.00	"	Athlone, Twyford	3.83
"	Ingleby Greenhow	2.97	"	Mullingar, Belvedere	3.74
"	Mickleton	3.58	XXII.	Woodlawn	5.00
X.	Bardon Mill, Beltingham	2.92	"	Westport, Murriak Abbey	...
"	Ewesley, Fallowles	...	"	Collooney, Markree Obay	5.50
"	Ilderton, Lilburn Cottage	2.94	"	Mohill	5.00
"	Kewick, York Bank	6.73	XXIII.	Enniskillen, Portora	5.91
XI.	Llanfrehfa Grange	4.43	"	Warrenpoint, Summer Hill	4.51
"	Treherbert, Tyn-y-waun	11.20	"	Banbridge, Milltown	4.31
"	Carmarthen, The Friary	4.41	"	Belfast, Springfield	5.73
"	Castle Malgwyn [Llechryd]	4.06	"	Bushmills, Dundarave	4.97
"	Plynlimon	1.53	"	Stewartstown, The Square	4.71
"	Crickhowell, Ffordlas	5.00	"	Killybegs	...
"	New Radnor, Ednol	4.64	"	Horn Head	4.61

METEOROLOGICAL NOTES ON JUNE, 1907.†

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—An extremely ungenial and harsh month with an abnormal amount of cloud and great want of warmth and sunshine. The R, although falling on an excessive number of days, was normal in amount. Mean temp. $58^{\circ}0$, or $2^{\circ}4$ below the average. Duration of sunshine $146^{\circ}5^*$ hours, and of R $31^{\circ}0$ hours.

CROWBOROUGH.—Gloomy, cold and unseasonable, with great absence of sunshine, and persistent cold W. and S.W. winds throughout. The mean temp., $53^{\circ}7$, was $3^{\circ}5$ below the average and $1^{\circ}1$ below that of June, 1903, which was in many respects similar. R $\cdot 56$ in. above the average; there were not three consecutive days without R. TSS on 1st and 9th.

TOTLAND BAY.—The windiest and coldest June in 21 years. Total wind movement 8,805 miles, and mean temp. $55^{\circ}0$. Duration of sunshine $175^{\circ}3^*$ hours, or $36^{\circ}0$ hours below the average.

TORQUAY.—Duration of sunshine $167^{\circ}1^*$ hours, or $62^{\circ}2$ hours below the average. Mean temp. $55^{\circ}7$, or $2^{\circ}9$ below the average. Mean amount of ozone $5^{\circ}4$.

NORTH CADBURY.—A terrible month, cold, showery, cloudy and excessively windy, with not one calm day. The max. temp. was by far the lowest yet recorded in June, but the min. was only slightly below the average. R only $\cdot 04$ in. above, but rain days more than double, the average of 10 years.

BOLTON.—Enormous R, $3^{\circ}02$ in. in excess of the previous highest fall in June. The pressure, duration of sunshine and temp. were the lowest in 21 years. Mean temp. $51^{\circ}2$, or $4^{\circ}3$ below the average. Duration of sunshine $88^{\circ}3^*$ hours, or $66^{\circ}6$ hours below the average. Wind practically always S. or W.

SOUTHPORT.—R $3^{\circ}76$ in., and rain days 11, above the average of 35 years and the greatest in that period. Mean temp. $54^{\circ}7$, or $2^{\circ}6$ below the average. Duration of sunshine 150^* hours, being 70 hours below the average. Duration of R $90^{\circ}8$ hours.

HAVEFORDWEST.—Cold, wet and stormy throughout, being the wettest June since 1882. Duration of sunshine $159^{\circ}1^*$ hours.

DOUGLAS.—The coldest June of which there is any record, the mean temp. being $4^{\circ}1$ below the average. That of the last fortnight was much below that of the first. The R had been slightly exceeded twice in 33 years, but the duration of sunshine only in 1897, which, however, was far warmer.

GIRVAN.—By far the wettest and coldest June in 33 years.

STRONVAR.—Very wet and cold. All growth was at least a fortnight later than can ever be remembered in this district.

COUPAR ANGUS.—The mean temp., $51^{\circ}9$, was the lowest in 27 years, and the R the heaviest in that period except in 1897.

LOCHMADDY.—R about double the average, and only twice approached during 23 years. The number of rain days was the highest ever recorded.

DRUMNADROCHIT.—R $2^{\circ}08$ in., and rain days 11, above the average of 25 years. The R was once exceeded, but the rain days never. It was altogether cold, cheerless and boisterous, without sunshine.

DUNMANWAY.—Very wet, cold and unlike June. In some places potato blight began about the middle of the month. TS on 23rd with H stones as large as small marbles.

CORK.—Mean temp. the lowest in June for 25 years, that of 1902 being the same. R $\cdot 77$ in. above the average.

MILTOWN MALBAY.—Colder and with less sunshine than last November. Pierce N.W. gales, eternal R and H prevailed till the end.

DUBLIN.—A more inclement June than that of the memorable year of 1879, establishing records for low temp., high wind and frequency of R. Mean temp. $55^{\circ}9$, or $2^{\circ}1$ below the average. TSS on 10th and 24th.

† See also p. 107.

* Campbell-Stokes.

Climatological Table for the British Empire, January, 1907.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Max. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
London, Camden Square	51·4	1	22·1	24	43·1	34·1	35·5	87	73·7	19·7	·91	8	...
Malta	...	...	...	...	...	...	...	...	...	...	...	...	...
Lagos	90·0	29	70·0	17	87·5	76·7	72·9	78	150·0	67·0	1·10	4	7·9
Cape Town	98·2	31	52·5	15	78·1	60·6	56·5	64	...	...	·57	4	2·6
Durban, Natal	90·7	6	63·2	12	82·8	68·4	...	...	153·6	...	3·02	22	5·7
Johannesburg	78·4	3	52·0	23	72·9	56·0	57·4	81	161·9	51·1	7·22	22	5·9
Mauritius	88·5	21	66·0	20	85·0	70·0	67·2	73	153·0	60·4	1·70	20	6·2
Calcutta... ..	86·6	28	52·1	2, 3	80·0	57·7	57·4	68	133·6	45·3	·00	0	1·1
Bombay	88·9	1	66·3	11	84·9	70·4	65·9	70	136·3	56·9	·00	0	0·6
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Kodaikanal	70·4	28	40·8	15	62·8	46·3	42·3	64	128·9	19·9	·97	4	3·6
Colombo, Ceylon	90·4	1	69·6	26	87·3	72·6	70·8	78	150·8	66·8	·83	7	3·5
Hongkong	75·0	1	45·0	31	66·3	57·0	51·4	69	129·9	...	3·45	7	4·4
Melbourne	85·6	18	49·9	10	76·0	57·0	53·7	71	151·2	39·5	1·10	4	5·4
Adelaide	106·3	18	50·9	29	82·5	59·0	52·4	53	159·8	45·8	·10	2	2·9
Coalgarda	104·2	26	47·9	19	87·6	59·1	48·8	42	172·2	45·0	·23	5	2·2
Sydney	88·0	6	59·8	11	78·5	65·0	60·4	66	129·4	52·8	2·69	20	7·1
Wellington	80·2	9	46·0	19	69·7	58·1	54·0	70	139·0	37·0	3·34	8	5·0
Auckland	84·0	28	50·0	19	73·2	61·8	58·0	72	147·0	43·0	7·45	12	5·6
Jamaica, Negril Point.	90·9	14	61·0	31	84·8	67·0	66·0	74	...	...	·89	5	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	85·2	30	67·8	30, 30	81·6	71·2	71·5	81	146·0	...	2·54	18	3·7
Toronto	51·4	20	-10·0	24	28·3	15·7	21·4	86	57·0	-13·9	2·32	6	7·9
Fredericton	47·5	20	-21·2	17	20·1	-1·5	...	74	...	...	·94	4	5·3
St. John's, N.B.	49·5	1	-17·0	17	25·9	7·2	...	...	...	...	1·32	5	5·4
Victoria, B.C.	48·2	21	14·8	15	37·6	28·9	...	...	...	...	2·64	10	6·5
Dawson	20·0	13	-59·0	20	-15·2	-30·9	...	...	...	...	·00	0	6·4

Johannesburg.—Bright sunshine 53 per cent. of possible amount.

Mauritius.—Mean temp. of air 2°·2, dew point 3°·0, relative humidity 2·5 per cent., and *R* 5·55 in. below, averages. Mean hourly velocity of wind 7·8 miles, or 2·1 below average.

KODAIKANAL.—Bright sunshine 249 hours.

COLOMBO.—Mean temp. of air 79°·3 or 0°·2 above, of dew point 0°·8 above, and *R* 2·73 in. below, averages. Mean hourly velocity of wind 8·5 miles.

HONGKONG.—Mean temp. of air 61°·4. Bright sunshine 195·8 hours, or 55 hours above average. Mean hourly velocity of wind 12·4 miles.

Adelaide.—Mean temp. of air 3°·3 below, and *R* 76 in. below, averages.

Sydney.—Mean temp. of air 0°·2 above, and *R* 79 in. below, averages.

Wellington.—Mean temp. of air 63°·9 or 1°·1 above, and *R* 12 in. below averages.

Auckland.—Excessively wet and stormy from 9th to 16th; 2·15 in. of *R* fell on 14th and 1·82 in. on the 15th, and 7·08 in. between the above dates. The total for the month, 7·45 in., was the largest for January ever recorded here.

Symons's Meteorological Magazine.

No. 499.

AUGUST, 1907.

VOL. XLII.

THE BRITISH ASSOCIATION AT LEICESTER.

THE annual meeting of the British Association for the Advancement of Science took place at Leicester, from the 31st of July to the 7th of August. The local arrangements were admirably carried out, the receptions and garden parties were so brilliant that the oldest frequenter could not say that he had ever seen finer. The excursions were well planned and much appreciated. The hospitality of the people of Leicester fulfilled the best traditions in the history of the Association—even the weather lent itself for once to the success of the meeting. The number of members was smaller than usual, and as a result the sum available for distribution in aid of science was less than of recent years; but the Kite Committee and the Committee for the publication of the Ben Nevis observations, each received a grant of £25.

The Meteorological Breakfast—the seventh of the second series—was held at the Grand Hotel, on the morning of Tuesday, the 6th, and there were 26 meteorologists and rainfall observers present, ladies as well as gentlemen taking part. The following is the complete list:—

J. Abercromby Alexander Bedford	E. Kitto Falmouth
Dr. J. R. Ashworth ... Rochdale	Dr. H. R. Mill London
G. H. Barber London	Mrs. H. R. Mill "
C. O. Bartrum "	J. E. Petavel, F.R.S. ... Manchester
Col. Bigg-Wither ... Godalming	A. Pilling Capetown
Dr. Otto Boeddicker ... Birr	E. A. Reeves London
G. G. Chisholm London	Dr. W. N. Shaw, F.R.S. ... "
Laurence Gomme London	Mrs. W. N. Shaw "
Mrs. Gomme "	M. B. Slater Malton
Allen Gomme "	C. Michie Smith Kodaikanal
Charles Hawksley, C.E. ... "	John Smyth, C.E. ... Banbridge
A. R. Hinks Cambridge	Miss C. O. Stevens ... Reading
T. V. Hodgson Plymouth	Prof. H. H. Turner, F.R.S. Oxford

Reference was made at the breakfast to the fact that this gathering was the only one in connection with the Association at which those interested in observational study could meet together in virtue of their particular interests, and the opinion was expressed by more than one speaker that the time had fully come when meteorology should have separate recognition amongst the sections.

H

The meteorological papers which had been accepted by Section A were put down in the programme for Tuesday, but they were, as in former years, sandwiched alternately with papers on astronomy and optics, in such a way that everyone was heartily tired of waiting after hearing one paper in which he was specially interested before the next on a cognate subject was reached. The grievance is no new one; but whatever respect one feels for the dignity and distinction of the austerest section of the Association, it is no longer possible to refrain from definite criticism. In our opinion, and in this opinion we are not alone, Section A is overloaded with material too diverse to be held together under a common label. Even if the Section is sometimes sub-divided the science of meteorology, for which alone we speak, is unfairly treated. This year there was no physicist known to be sympathetic with meteorology amongst the officers of the section, and scarcely one amongst the meteorologists present at the meeting was upon the Committee. We say scarcely one, for one whose name most properly appeared was not present on the earlier days, and so was unable to do anything to improve matters. We hold the officials of the Section entirely responsible for the faulty arrangement and bad time-keeping, which made it impossible for important meteorological papers to be treated adequately, and caused even the reporters of that Gallio in matters scientific, the *Daily Mail*, to comment on the situation. There was a little grievance also, which the mathematicians and physicists of Section A shared with their more neglected colleagues,—this was the bewildering acoustic properties of the hall where the meetings were held. When the speaker faced a particular member of the audience and spoke distinctly that particular member heard perfectly; but when the speaker turned his head, ever so slightly, a confused reverberation made the words indistinguishable, and when he turned at right angles to the hearer, an exquisitely sharp echo sprang into being, so that if he spoke slowly every word was heard twice, if he spoke rapidly nothing was distinguishable but the last word of the sentence, duplicated with ringing emphasis. We amused ourselves after we had to give up the attempt to understand the papers by following with eyes shut the changes in azimuth of the speaker's head by the changes in the echo accompaniment.

Taken all round, the meteorologists had a bad time in the sections, and it is sincerely to be hoped that a new section—or at least a sub-section with a chairman, who is interested in observational studies—will be formed at an early date, otherwise it will not be worth while for any meteorologist to offer a paper to the British Association. One is strongly tempted to believe that the type of scientific mind which prevails in the quarters whence such institutions as the British Association are directed, holds that methods are all-important, and results useful only as proving the applicability of methods, while the data are merely looked upon as algebraic symbols, a or b serving as stepping stones to x and z , and not as

actual phenomena, the comprehension of which is the sole justification for applying any method at all. At the Meteorological or any other breakfast, we do not consider that the end of the meal is served when we have proved that knife and fork and spoon can be applied to reduce certain solids and liquids to an assimilable form. The nature of the food is universally regarded as the most important thing, whether it be served with steel or silver. To us, as students of nature, the subject of study must always be more important than the methods which help us in the task.

The difficulties in the way of hearing and discussing the meteorological papers this year were the more disappointing because several of those which were presented were of exceptional interest, and we much regret the inadequate reports which we must offer to our readers. Although we look upon the data and the result of their discussion as much more important than the methods employed, we are fully aware that there is great scope for the treatment of meteorological statistics by new methods, and thus we hailed the discussion to be introduced by a paper on "Modern Methods in Meteorology," by Mr. Palin Elderton, with pleasurable anticipations. Unhappily, the Abstract supplied gives a minimum of information, but it is all we have to offer. Dr. Shaw's paper on new methods in forecasting from synoptic charts was cut cruelly short, on account of the failure of presidential compression in the case of a previous astronomical paper, and the reports on the extremely important kite and balloon observations were no better treated.

In other Sections there was little of meteorological importance, though some speculations of an interesting kind were made in a paper on "The Interior of the Earth," by Professor Milne, in Section C; and some rainfall data were brought forward by Mr. Smyth, of Banbridge, in Section G.

The following are the titles of the papers announced for reading in Section A, as set out in the Association's Journal:—

W. Palin Elderton.—Examples of modern Methods of treating Observations. The following members will take part in the discussion: Dr. W. N. Shaw, G. U. Yule and A. R. Hinks.

Dr. W. N. Shaw, F.R.S.—Recent Developments of the Methods of Forecasting by means of Synoptic Charts.

C. Michie Smith.—A Mountain Observatory in South India. (Lantern.)

Miss M. White, T. V. Pring and J. E. Petavel, F.R.S.—An analytical Study of the Meteorological Observations made at the Glossop Moor Kite Station during 1906-7.

Report of the Committee on Kites.

W. A. Harwood and J. E. Petavel, F.R.S.—Preliminary note on the recent International Balloon Ascents (Manchester station).

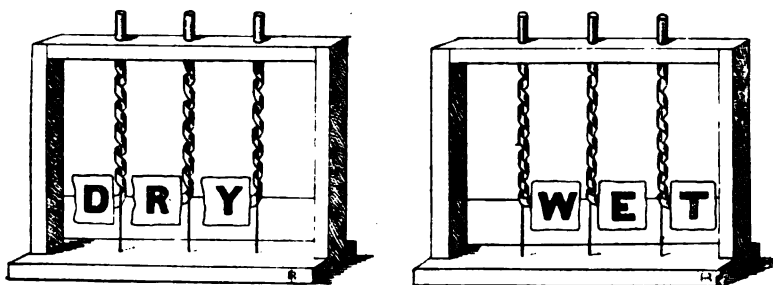
Report of the Ben Nevis Committee.

(To be continued.)

WEATHER WHIMS.—III. THE FOIL HYGROSCOPE.

BY RICHARD INWARDS.

MANY are the contrivances for showing changes of moisture in the air, but none is more sensitive than the silver-foil weather-flag, as depicted in the accompanying sketches. It consists of three slips of the foil used by jewellers to enhance the effect of precious stones, and sometimes to glorify pieces of plain glass so as to make them appear like gems. This foil consists of very thin silver or copper, coloured on one side with a kind of varnish, suitable for the purpose. I find that designed to imitate the sapphire does very well. It is of a fine blue colour. Three small slips are cut off by scissors (not a knife or the varnished part will peel off), these strips are then twisted round a wire until they resemble ringlets or shavings, as shown in the sketch, of course the wire is slipped out. These ringlets are supported as shown, and a needle set in the baseboard and running



up the hollow centre of each serves to keep it roughly in place, and to prevent breaking by accident. Three little paper flags are attached as shown, having on one side the letters DRY, and on the other WET. It will then be found that these flags turn round instantly when the air becomes damper or drier—indeed they will turn on the approach of a moist hand, or when they are ever so lightly breathed upon, and the strange thing is that they go back just as quickly when the damp stimulus is withdrawn. A wire stretched across the frame prevents the flags from going beyond the position where the letters are most visible. The spiral slips are fixed by secotine at the top to small pegs which can be turned round for adjustment if required.

It is of course the varnish or colouring matter which is the hygroscopic material. I have not been able to find out what this substance is, although I have experimented with gums shellac, dextrine and other things with negative results.

My friend, Mr. Augustus Stroh, pointed out this property of the foil to me and enabled me to construct this weather-toy, which I have had some time under observation with satisfactory results.

THE KITE DISPLAY OF THE AÉRONAUTICAL SOCIETY.

THE kite display organised by the Aëronautical Society of Great Britain, took place on Chobham Common, on July 1st, in the presence of a large assembly of the members and their friends, there being upwards of three thousand persons present.

At the time of the commencement of the display there were eleven large scientific kites in the air at the same moment.

Mr. W. H. Dines, F.R.S., exhibited two box kites with meteorograph of the kind in common use at the station of the Meteorological Office at Pyrtton Hill. One of these was 9 ft. high, having 77 square feet of lifting surface, and weighing 11 lbs. This is the type suitable for light and moderate winds of less than 40 miles an hour, and with 10,000 feet of wire will lift a meteorograph to a vertical height of 6,000 feet. The other was 7 ft. 6 in. high, having 52 square feet of surface, and weighing 9 lbs. This type will fly in winds ranging from 25 to 50 miles an hour, and with 5,000 feet of wire will carry the recording instruments to a height ranging from 3,000 to 3,500 feet. Mr. Charles Cave also displayed a kite of the type used by Mr. Dines. Mr. Salmon's exhibit was remarkable for originality and the number of kites exhibited. One of these kites was made specially for this display, and had nine wings at each side of a backbone 18 feet high. The wings have a span from tip to tip of 10 feet. Mr. Salmon claims that this type of kite is well adapted for light winds and is easy to manipulate. Such a kite has often enabled him to raise his meteorograph 1,600 feet, when a box kite would not have left the ground. Mr. Salmon's claims were supported by actual test in this display, when with the light wind blowing the kite attained a height of some 3,000 feet. Mr. Salmon also contributed several types of box kites, and a Hargrave kite made by Mr. Hargrave. Some of the box kites had the acute angle to the front and some the obtuse. Other kites shown by the same exhibitor were a quinquangular box kite and the Barclay honeycomb kite.

Mr. Charles Brogden, who in the Aeronautical Society's Kite Competition at Finden, in 1903, attained the highest flight with his six winged bird kite, again gave a demonstration of the admirable flying qualities of this kite. On the latter occasion the height attained was estimated at about 3,000 feet (perpendicular), 3,800 feet of wire being out. The angle of the kite was fairly constant at 56 to 50 degrees from the horizontal.

Mr. Balston exhibited Zenith kites and Butterfly kites. The former are adapted for flights in strong winds, and the latter for light winds.

A Ballon-Sonde with the light meteorograph designed by Mr. Dines, recording pressure and temperature, was sent up by Mr. Charles Cave. A small rubber balloon was used having a capacity of between six and seven cubic feet when unstretched, but capable of expanding to a much larger size. The balloon was filled with

hydrogen, and had a linen parachute placed over it to which the meteorograph was attached. The ascent of the balloon was observed with theodolites placed at each end of a base of about 1,560 feet, set out at right angles to the direction of the wind. One theodolite was an ordinary transit instrument, the other has been specially designed by M. de Quervain for observing balloons. It has a reflecting prism in the axis of the telescope, so that the observer is always looking in a horizontal position even if the balloon is passing through the zenith. The balloon fell at Upminster, Essex, 41 miles east by north half north.

Mr. José Weiss performed some highly successful experiments with model gliders. There were three of these gliders exhibited, having wing areas of 3·6, 8·4 and 12·8 sq. ft., with total weights of 2½ lbs., 6 lbs., and 15 lbs. respectively; the lead ballast in each case representing about two-thirds of the total weight.

When launched from the highest hillock available the best glides obtained were some 200 yards in length, with a drop of from 30 to 50 feet. The small model, raised some 200 feet by Mr. Brogden's large kite, and released from that height, righted itself instantly in each case and gave some very fine glides, the longest being about 200 yards.

E. S. B.

ROYAL METEOROLOGICAL SOCIETY.

THE last meeting for the present session was held at the Society's Rooms, 70, Victoria-street, Westminster, on Wednesday afternoon, June 19th, Dr. H. R. Mill, President, in the chair. Exigencies of space make it necessary to condense our report greatly.

Mr. F. Campbell Bayard read a paper on "Weather and Crops, 1891—1906." Mr. R. H. Hooker, Mr. R. Cooke, Mr. R. G. K. Lempfert and the President took part in the discussion.

A paper by Dr. C. P. Hooker on "The Relation of the Rainfall to the Depth of Water in a Well" was also read. The author gave the weekly measurements of the depth of water in a well 101 feet deep at Further Barton, Cirencester, compared with the weekly rainfall for the years 1903 to 1906, in continuation of an earlier paper to the Society dealing with the measurements of the same well for the years 1887—1902. The well measurements have now terminated on account of the death of the former owner.

Mr. Baldwin Latham believed that a thorough investigation of the level of water in wells would throw much light on the subject of crops. He thought that water percolated in excess in some years, robbing the earth of its nutriment, and consequently impoverishing the next crops.

Mr. Walter Child exhibited and described his "Step" Anemometer, which he has designed to obviate the "sheltering error." This instrument is a Robinson Anemometer, with the cups so

placed on the spindle that the arms are in different horizontal planes, thus one cup does not shelter another and the system comes to rest more rapidly when the wind drops.

The following gentlemen were elected Fellows of the Society:—Lieut. J. Adams, R.N.R., Sir Philip Brockelhurst, Bart., Capt. G. S. Cary, Mr. H. Chapman, Mr. J. I. Craig, M.A., Lord Ronald Sutherland Gower, Mr. G. S. Marshall, Mr. E. H. Shackleton (leader of the British Antarctic Expedition, 1907), Mr. F. R. Shackleton, Mr. D. S. Steuart, and Sir Arthur Vicars, K.C.V.O., Ulster King of Arms.

SCOTTISH METEOROLOGICAL SOCIETY.

The usual half yearly meeting of this Society was held in Edinburgh on July 9th. The Report from the Council of the Society to the General Meeting was presented, and contained the following among other paragraphs:—

Since the last meeting of the Society, the Station at Clathick, Perthshire, has been discontinued. The Council, however, are glad to say that instruments formerly at Clathick have been removed to the Strathearn Hydropathic, Crieff, where a Station has been opened under the charge of Dr. Meikle.

It is with profound sorrow that the Council have to report the death of Dr. Alexander Buchan on 13th May last. Appointed Meteorological Secretary in 1860, when the Society was in its infancy, Dr. Buchan occupied that position for the long period of forty-seven years. This is not the place to refer to the many and great services rendered by Dr. Buchan to Meteorological Science, but the Council desire to record their sense of how much the Society owes to him. The results of many of Dr. Buchan's most important researches appeared first in the Society's *Journal*, and the welfare and honour of the Society were ever his foremost consideration. For nearly half a century the Society has been guided by a man whose faithful use of great natural gifts brought him a world-wide reputation, and whose ungrudging service has given the Society prominence in the scientific world. The Council propose to include in the next issue of the *Journal* papers dealing with various aspects of Dr. Buchan's scientific career.

The Council have appointed Mr. Andrew Watt, M.A., F.R.S.E., Meteorological Secretary to the Society. Mr. Watt had been for some time Assistant-Secretary, and largely responsible for the general work of the Society.

After the Report had been received tributes to the memory of Dr. Buchan were paid by Lord McLaren, Sir John Murray, Mr. J. G. Bartholomew, Mr. R. T. Omond and Mr. A. Watt. No meteorological papers were read, the meeting having very appropriately assumed the form of a memorial to the late Meteorological Secretary.

BEN NEVIS OBSERVATORIES.

WE quote the following from the Parliamentary Report in *The Times* of Friday, August 2nd :—

Mr. McCRAE (Edinburgh, E.), on behalf of Sir J. Dewar (Inverness), asked the Chancellor of the Exchequer if he was in a position to say whether he was able to accede to the request of the Scottish members of Parliament for a grant to the Scottish Meteorological Society for the purpose of re-opening and maintaining the Ben Nevis Observatories.

THE CHANCELLOR OF THE EXCHEQUER (Mr. Asquith).—The only scheme which has up to the present been placed before me is one under which the whole cost is of the re-equipment and maintenance of the Observatories would be thrown upon public funds, and to this I should not feel justified in assenting. I am, however, quite prepared to consider the question of renewing the Government grant, which was for many years given to these institutions through the Meteorological Council, provided that an adequate contribution towards their re-establishment and maintenance is forthcoming from other sources.

THUNDERSTORM RAINS OF JULY, 1907.

THE monthly rainfall maps in summer always present irregularities of distribution, due to heavy falls of rain during thunderstorms of short duration which affect small areas, and we are overwhelmed with correspondence on the subject, all of which we are glad to get, though we cannot find space to give all the communications in the words of the authors. The following particulars given in order of date, deserve to be put on record, and we thank our correspondents for their kindness in sending them.

July 10th.—MR. S. F. HURNARD, of Hill House, Lexden, near Colchester, reports that a severe thunderstorm passed over his station. Rain fell from 9.55 a.m. to 11.30 a.m., and yielded 1.30 in. in 1 hr. 35 min. Included in this measurement was a heavy fall of hail, which occurred between 10.40 and 11.10 a.m. Another lesser storm occurred about noon, and the total reading for the 24 hours was 1.70 in. Another rain gauge, $1\frac{1}{2}$ miles to the east, yielded .90 in., and a third still farther east only .76 in.

July 19th.—MR. JOHN SMYTH, Milltown House, Banbridge, sends particulars of a thunderstorm with remarkably heavy hail. The storm occurred in the afternoon and evening, and at Lenaderry and other places the hail broke large quantities of glass. In one case 600 and in another 382 panes were broken.

July 21st.—MISS A. PLEYDELL BOUVERIE, The Old House, Market Lavington, Wilts, said that thunder was heard about 3.30 p.m., and rain began to fall about 3.45, lasting until 7.30 p.m., and yielding 2.55 in. in $3\frac{1}{4}$ hours. Hail accompanied the rain.

DR. SYMONS, writing from the Health Office, Guildhall, Bath, reports a rainfall of 2.90 in. at Combe Park, 2.69 in. at Henrietta

Park, and only 1.25 in. at the Statutory Hospital, $2\frac{1}{2}$ miles to the south-east. The rain fell between 4 and 7 p.m.

MR. R. LEWIS LLOYD, Somerset Place, Lansdown, Bath, reports that rain began at 4.5 p.m. At 5.15 p.m. the rain moderated, and he found that 2.49 in. had fallen in 1 hour 10 min. The total fall, measured at 9 a.m. next day, was 3.27 in. He considers that Lansdown had the most severe fall in Bath on this occasion.

REV. J. TOMSON, The Rectory, Rochford, Tenbury, heard thunder about noon far away to the north-west, and at 2.45 p.m. it broke overhead, the wind suddenly rising, and by 3.15 p.m. 1.61 in. of rain was measured as the result of half-an-hour's fall. It was accompanied by hail of great size, including irregular pieces of hard clear ice. The area seriously affected was narrow, not exceeding a mile from east to west. In one hop garden the damage done by the storm was estimated at £600.

MR. LEWIS H. WILLIAMS, Edenderry, King's County, reports a fall of 1.14 in. in 20 minutes, from 5.50 to 6.10 p.m.

The storm was exceedingly severe in the north of Ireland, a fall of 1.98 in. in about an hour-and-a-half being reported by MR. JOSEPH H. WELCH, of Londonderry, as occurring in the Shantallow district. Other heavy falls on the 21st were Bourton-on-the-Water 2.06 in., Hampson-in-Ellel 2.13 in., and Prestbury 1.97 in.

July 22nd.—The storms on this date were so remarkable that we devote special attention to them. One very heavy outburst occurred just to the north of London, producing in a few hours three times as much rain as fell in the south of London during the whole month.

MISS ABETHELL, Colney Hatch Lane, Muswell Hill, N., reports that the storm was very heavy from 2.50 to 6.30 p.m., by which time 1.95 in. had fallen in 3 hours 40 mins., and .35 in. fell subsequently, making the total for the 24 hours 2.30 in.

MRS. H. R. MILL, The Hollies, Mill Hill, N.W., measured 2.15 in. at 6.40 p.m., the result of $3\frac{1}{2}$ hours rain, and at 9 a.m. next morning the total reached 2.35 in. The lightning was of blinding intensity and the thunder terrific. The torrential rain washed out channels from 6 to 8 inches deep in firm gravel walks.

MISS STANTON, of Upfield, Stroud, writes, that after a thunder-storm on the 21st, yielding .40 in. of rain, another came up from the north-west on the afternoon of the 22nd, with very heavy rain, 1.83 in. falling in 1 hour 30 min. from 3 p.m. to 4.30 p.m.; the rain continued with less intensity until 7.15 p.m., by which time 2.16 in. had fallen.

REV. R. P. DANSEY sends newspaper cuttings descriptive of the storm on the border of South Wales, and supplements them by a full and most interesting account of the work of the storm in the Black Mountains, which we hope to publish later with illustrations. Meanwhile we quote the following from the *Hereford Times* :—

The storm which approached from Talgarth way, over the Black Mountains, broke about 2 o'clock, and in a very short time the river Monnow

rose enormously, and the adjoining fields were flooded two or three feet deep. A remarkable phenomenon was the fierce shower of hailstones, which varied from the size of a walnut to a hen's egg In one portion of the Llanthony Road, for about twenty yards, the hailstones had fallen over 5 feet in depth, and the road was impassable for either vehicles or pedestrians. The Cwnyoy postman, who was returning to Abergavenny, had to leave his horse and cart behind and make his way through the ice and water as best he could On a piece of road from Henllan to Holly Pitch the road metal was carried right away, and at the bottom of the pitch there is a deposit of about 50 tons.

The district which suffered the worst of all was in the neighbourhood of Tredrenow, where the hailstones fell in such volume and force that they completely blocked the river, turning it out of its course across the road and the land adjoining. Numbers of trout and other fish were left on the road and in the fields.

Another observer writes in the same paper that he had great difficulty in getting through the great mass of hailstones on Tuesday forenoon, the day after the storm. At one place, along 40 yards of the road, the hail, which had been crushed down by the traffic, was still one foot deep, and at the sides of the road quite 5 feet. About half or three-quarters of a mile above Tredrenow, he saw an enormous chasm on the north side of the valley, down which a torrent was roaring, and he continues as follows :—

When I stopped fishing, I had a good look at the area of the storm coming back, and judged it to be nearly three-quarters of a mile wide. There was a fairly clearly defined line on each side where no hail had fallen at all, but within its area practically all vegetation had been shattered (short of trees). Bark was stripped from hedges, dock leaves reduced to skeletons, and corn simply made into pulp. I carefully examined the hailstones, and found them the size of large marbles. Eighteen hours before they must have been as large as pigeon's eggs. I was told that in the valley of the Grwyny (the next valley south) the storm was even worse.

REV. PHILIP STAPLETON, S.J., of St. Beuno's College, St. Asaph, says that a severe storm passed up the vale of Clwyd in the night. It began about 1.30 a.m., and the lightning was frequent and vivid, heavy rain commenced about 1.45 a.m., and lasted, with breaks, until about 4.30, in that period of 2 hrs. 45 mins., 1.22 in. fell.

Other heavy falls reported on the 22nd were 2.35 in. at Hornsey, London, N.; 2.12 in. at Etchingham Park, Finchley; 2.65 in. at Watford; 2.29 in. at New Inn, near Brecon; and 1.93 in. at Witney. The following stations reported falls exceeding an inch on the two consecutive days, 21st and 22nd.

Station.	New Inn.	Prestbury.	Torpantau.	Gt. Barrington.	Northleach.	Witney.
21st ...	1.01	1.97	1.20	1.60	1.54	1.25
22nd...	2.29	1.61	1.30	1.16	1.08	1.93
Total..	3.30	3.58	2.50	2.76	2.62	3.18

July 30th.—REV. A. I. BRINE, of Willesborough Rectory, Ashford, Kent, reports a thunderstorm of 13 minutes duration, com-

encing at 2.1 p.m. In the first five minutes .25 in. of rain fell, and the whole fall for the 13 minutes was .38 in.

MR. J. BEETHAM WILSON, High Street, Dorking, writes that .15 in. of rain fell in 10 minutes from 3.20 to 3.30 p.m., in a sharp thunderstorm.

In spite of the heavy falls quoted above the month as a whole was a dry one, the deficiency from the average being about 22 per cent. for the British Isles as a whole.

THE THUNDERSTORM OF JULY 22nd IN SOUTH-EAST CLARE.

By LIEUT.-COL. W. C. BENTLEY.

THERE were two distinct thunderstorms on the 22nd. The first came from the south-east, and went to the north-west, passing well to the north of Broadford. It began at 3.30 p.m., and ended at 5.30 p.m. There were only a few drops of rain at Broadford, Hurdles-town, but I could see there was much rain farther to the north-east.

The second storm began at 5 p.m., and lasted till 10 p.m. It came at right angles to the course of the first storm; that is to say, from the south-west passing to the north-east. There appeared to be much rain to the north; but here only .22 in. was recorded next morning. But the drops of rain were very large. There must have been a teaspoonful of water in each of them, as the splash they made on the dry dusty roads was about an inch and a half in diameter.

There is a small district east of the Kilbane mountains, lying between that place and Killaloe, where a tremendous fall of rain took place. It is only four miles by the mountain road from Kilbane to Killaloe, one mile of which is on the west side of the pass, and three miles on the east side. On the 27th, five days after the storm, I walked this road from Kilbane to Killaloe. Hardly any rain had fallen on the west side of the pass, as the road was hardly washed clean; but on the east side the road was clean gone. Great cuts were made in it, some ten feet deep, and in one place there was a gap fully 30 feet deep. Four times I had to get into the fields in half-a-mile, as the cuts in the road were too wide and deep to get over. Between that and Killaloe there are two small rivers. I had to ford both, as the two bridges had been carried away. But one may judge how small these rivers are, when I carried my bicycle over them without getting my feet wet. One was only a wooden foot bridge, and the flood took it at once; but the other was a large stone arch, 25 feet high and 20 feet wide. Not a sign of this bridge was left; the very foundations on the solid rock were carried away. The oldest man in that neighbourhood never remembers such rain, or such a flood, as there was that evening. I was told that the hail fell not in the form of round stones, but in large rugged lumps of ice.

The whole mountain side for 3 miles was a flood everywhere. Great damage was done; farm-houses were flooded, sheep and pigs carried away, and crops destroyed. Whole fields of potatoes and turnips were washed clean away. On the bank of one of the rivers a dead ass was left in the fork of a tree, 15 feet above the ground, by the flood. In all five large stone bridges and one timber bridge were carried away. This all took place in a district 3 miles long and 1 mile wide. For a mile south of the mountains, the roads were hardly washed, yet no sand or gravel was left in either of the rivers, it was all washed away down to the hard rock. On the banks of one river there was a small wood of very large and old beech trees, nearly all of which were torn up by the roots; and a road was washed clean away for about 100 yards. It will cost the County Council about £3,000 to repair the roads and bridges; and the damage to private property must amount to as much more.

Correspondence.

To the Editor of Symons's Meteorological Magazine,

LOCAL STORMS.

THE last number of your Magazine is almost as interesting to me for what it omits as for what it reports. I refer to the absence of any reference from Camden Square of the brisk thunderstorm which was observed here during the late afternoon of Saturday, 29th June. It seemed to come from S.S.W.; and I see by the splendid report of Mr. G. von U. Searle, on page 112, that he also experienced it in West Kensington.

The storm put into my gauge .92 in. of rain, making the month's "takings" 3.09 in.; it gave Mr. Searle 1.22 in., so raising his total to 2.92 in.—curiously near to my own; and as the month's fall in Camden Square was without it 2.03 in., if this storm had called and treated you as liberally as it did us, we should have stood pretty nearly on the same level. Does anybody happen to know the extent of the area affected? One feels he would like to understand what is the guiding or limiting factor in the development of such phenomena.

WILLIAM GODDEN.

38, Burrard Road, West Hampstead, N. W., 19th July, 1907.

[The storm of June 29th brought .42 in. of rain to Camden Square. All thunderstorms bring intense rains to small and often curiously outlined areas, the position of which is carefully studied and mapped for as many storms as time permits in *British Rainfall* for each year. The storm of July 22nd was much more remarkable in this respect than that of June 29th.—ED. S.M.M.]

“A BUSHEL OF MARCH DUST IS WORTH A KING'S RANSOM.”

I HAVE always understood this saying to refer, not to the probable character of the ensuing summer, but to the value of a dry March from an agricultural point of view—as being favourable for spring sowing and cultivation. The beneficial effects of a dry spell at this season are undoubted; and no farmer was ever heard to complain of a dry March, especially if followed by seasonable “April showers.”

Clifton, 25th July, 1907.

ROBT. F. STURGE, F.R.Met.Soc.

COMPARISON OF SEASONS.

I WAS interested in Mr. McDowall's conclusions in the July magazine especially with regard to a dry March preceding a warm summer. My records for the Southern Counties are only complete for the 24 years 1883–1906, in which 8 dry Marches—at least half-an-inch below the average—were succeeded by 7 warm summers and 1 cold, i.e., $87\frac{1}{2}$ per cent. This seems remarkable, although the period is obviously too short to establish a rule for these results.

The following also refer to the same period of 24 years :—

Mild or cold winters, followed by summers of the same character—
16 times out of 22, or 73 per cent.

Warm or cold springs 14 “ “ 20, or 70 “

Wet or dry winters 5 “ “ 18, or 28 “

“ “ springs 11 “ “ 16, or 66 “

Haslemere, Surrey, August 5th.

ARTHUR F. PARBURY.

PHOTOGRAPHIC SUNSHINE RECORDERS.

WITH reference to your remarks in the October number of the *Meteorological Magazine* for 1906 (p. 168) regarding the Jordan Sunshine Recorder, I made a series of comparative observations with this instrument and the Campbell-Stokes Recorder during the months of March and April of the present year. The results of these experiments I venture to submit to you herewith, and, thinking you may be interested to compare the *actual* records, I likewise send them for your perusal.

I find that the Jordan recorder registered 15 hours more sunshine than the Campbell-Stokes in the period of 61 days. During those months there was an exceptional amount of bright sunshine, especially in March. I think that the difference in the two registers may be accounted for by the prevalence of much haziness in the atmosphere and by early hoar frosts, which would retard the burning action of the rays more than they would affect the photographic action.

I should state that the two instruments were supplied by Messrs. Negretti and Zambra; they were placed side by side on the same

stand, and exposed to the full action of the sun, at an elevation of 200 ft. above the sea-level.

The photographic charts used were prepared at different dates as indicated, but I note no difference in their relative sensitiveness. In order to determine this point satisfactorily, it would be necessary to use two photographic recorders working side by side under similar conditions, with their charts prepared at different times.

Incidentally I note, with reference to the character of the traces produced by the Campbell-Stokes recorder, that during periods of sunspots they are in a marked degree more intensely burnt than at times when there are no sunspots. I am not aware if this effect is usually noticed by observers or whether it is merely accidental.

Comparative Records of the Campbell-Stokes and Jordan Sunshine Recorders, during the Months of March and April, 1907.

	Date.	Campbell-Stokes.	Jordan.*	Difference.	Weather Remarks.
		hours.	hours.	hours.	
Numerous large Sunspots. (See the Campbell-Stokes charts.)	Mar. 1	8.0	9.2	+1.2	Hoar frost in early morning.
	" 2	.6	.6	—	Sea fog off and on, cloudy.
	" 3	7.3	7.4	+ .1	" " fine.
	" 4	8.6	9.1	+ .5	Early frost and light sea fog.
	" 5	8.5	8.8	+ .3	" "
	" 6	9.1	9.2	+ .1	Fine. "
	" 7	2.7	3.3	+ .6	Hoar frost, cloudy.
	" 8	4.5	4.0	— .5	Cloudy.
	" 9	2.7	2.7	—	" "
	" 10	1.6	1.5	— .1	Showery.
	" 11	7.9	7.6	— .3	Cloudy.
	" 12	6.7	6.5	— .2	Early frost.
	" 13	6.5	6.7	+ .2	Fine, cloudy later.
	" 14	8.0	8.3	+ .3	" slightly hazy.
	" 15	.3	.3	—	Overcast and showery.
	" 16	—	—	—	Overcast all day.
	" 17	7.9	8.3	+ .4	Fine, cloudy.
	" 18	3.9	4.8	+ .9	Early haze and rain.
	" 19	9.1	9.3	+ .2	Fine. Sunspots disappear.
	" 20	7.5	7.8	+ .3	Fine.
	" 21	10.0	10.7	+ .7	Early frost, fine.
	" 22	6.9	7.0	+ .1	" afternoon cloudy.
	" 23	9.4	9.8	+ .4	Hazy in early morning.
	" 24	9.7	10.6	+ .9	" "
	" 25	8.2	9.7	+1.5	Early hoar frost and fog.
	" 26	9.4	9.6	+ .2	" "
	" 27	10.7	11.2	+ .5	Early haze, clear sunset.
	" 28	10.5	11.2	+ .7	Hazy horizon all day.
	" 29	10.0	10.4	+ .4	" and sea fog all day.
	" 30	10.7	11.1	+ .4	Hazy horizon all day.
	" 31	10.1	10.5	+ .4	" and sea fog.
		217.0	227.2	+10.2	

* The photographic charts used from March 1st to March 28th were prepared December 6th, 1906.

Comparative Records of the Campbell-Stokes and Jordan Sunshine Recorders during the Months of March and April, 1907—(continued).

	Date.	Campbell-Stokes.	Jordan.†	Difference.	Weather Remarks.
Numerous Sunspots.		hours.	hours.	hours.	
	April 1	9.5	9.8	+ .3	Hazy horizon, fine.
	" 2	9.3	9.3	—	Sea fog, fine.
	" 3	4.4	4.5	+ .1	Cloudy, fog and rain afternoon.
	" 4	4.7	7.0	+2.3	Thin filmy clouds all day.
	" 5	6.7	6.4	— .3	Cloudy, slight haze.
	" 6	6.4	5.7	— .7	" rain.
	" 7	2.7	2.7	—	" showery and some snow.
	" 8	2.5	2.5	—	Showery.
	" 9	3.8	4.6	+ .8	Cloudy.
	" 10	3.2	3.0	— .2	"
	" 11	4.3	4.3	—	Early fog, cloudy.
	" 12	—	—	—	Overcast, rain.
	" 13	9.0	9.0	—	Hazy in early morning.
	" 14	—	—	—	Overcast, rain.
	" 15	10.0	10.5	+ .5	Slight haze.
	" 16	3.3	3.3	—	Sea fog, overcast.
	" 17	8.1	8.1	—	Hazy horizon all day.
	" 18	7.2	6.8	— .4	Early hoar frost, cloudy.
	" 19	4.8	4.9	+ .1	"
	" 20	11.0	11.6	+ .6	"
	" 21	—	—	—	Overcast, rain.
	" 22	7.0	7.7	+ .7	Hazy horizon, fine.
	" 23	6.2	8.4	+2.2	" all day.
	" 24	11.3	11.0	— .3	Very fine and hot.
	" 25	1.7	1.7	—	Cloudy, overcast and rain.
	" 26	—	—	—	Overcast and rain.
	" 27	8.3	8.0	— .3	Hazy horizon, cloudy later.
	" 28	10.9	10.5	— .4	Fine.
	" 29	3.1	3.0	— .1	Cloudy.
	" 30	.4	.4	—	Overcast, showery.
Total, April ...		159.8	164.7	+ 4.9	
,, March..		217.0	227.2	+10.2	
,, Mar.&Apl.		376.8	391.9	+15.1	
Possible Sunshine, } 782 hours.					
March & April, }		48%	50%	+2%	

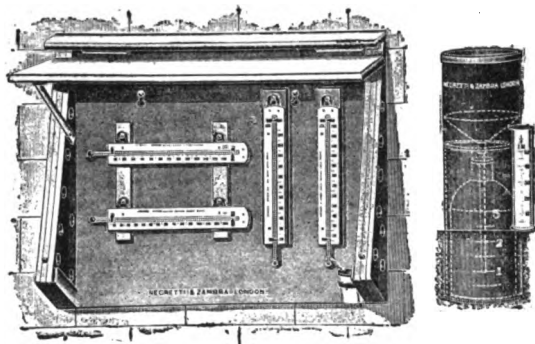
† The photographic charts used from March 29th to April 30th were prepared March 28th, 1907.

JAMES B. JORDAN.

"Hayfield," Hythe, Kent, June 10th, 1907.

A SIMPLE CLIMATOLOGICAL OUTFIT.

MESSRS. NEGRETTI AND ZAMBRA have introduced a simple set of meteorological instruments for climatological observations, intended to meet the demand for an accurate but low-priced equipment for use in schools, and for other similar purposes.



If the cost of a Stevenson screen is prohibitive, and if it is not the immediate intention of the observer to send his records to one of the Meteorological Societies or the Meteorological Office, we do not think that a better form of exposure for the thermometers could be devised than that hit upon by the makers in the "Public School Set." It is preferable, in our opinion, to the Glaisher stand which is still sometimes used, and it may be that it will prove as serviceable as the standard Stevenson screen itself.

The equipment consists of a maximum thermometer, minimum thermometer, wet bulb and dry bulb thermometers. These are hung on a board which is intended to be suspended on a north wall. The back is provided with projecting triangular sides, made of two boards held apart and pierced with holes in such a way as to admit air and exclude rain. A lid, hinged at the top, rests on these side boards when the screen is in use, and the protection is all that could be desired. When opened for reading, as shown in the illustration, the lid is supported by a moveable arm. In addition to the thermometers, the set includes a Snowdon rain gauge and graduated measure, an observation book, and a copy of "Hints to Meteorological Observers."

The instruments will all pass the Kew tests, and certificates can be supplied. We are fortunate in this country in having more than one firm of instrument makers whose name is a guarantee of the excellence of their workmanship, and no name stands higher with regard to meteorological instruments than that of the long-established firm of Negretti and Zambra.

EVAPORATION IN DESERT CONDITIONS.

We quote the following from a recent number of *Science* :—

"An exceptional opportunity for the study of evaporation in relation to climate is afforded by the Salton Sea. As our readers are aware, the sea was created by the accidental turning of the Colorado River into the Salton Basin, a dry valley in south-eastern California lying below the level of the ocean; and now that the river has been restored to its original channel, the sea has begun to dry away. The time required for its complete dissipation is estimated at from ten to fifteen years, and during that period the accession of water from all sources will be nominal. It will thus constitute an evaporation pan on a grand scale, and the measurement of its progressive lowering will give valuable information to engineers charged with the planning of reservoirs. The matter is also of importance to meteorologists, and arrangements have been made for a joint investigation by the U.S. Weather Bureau, the U.S. Reclamation Service and the U.S. Geological Survey. To determine the relation of the evaporation to temperature, atmospheric humidity and wind, a group of meteorological stations are to be maintained in the Salton Basin; and the endeavour will be made to develop a general formula for the estimation of evaporation in any locality where the ordinary climatic factors are known. A reconnaissance of the region has just been made by a board composed of F. H. Bigelow, C.E. Grunsky and G. K. Gilbert, representing severally the bureaus mentioned above."

THE CONDITIONS OF THE UPPER AIR IN INDIA.*

BETWEEN August 26th and September 12th, 1905, at a spot situated about nine kilometres west-north-west of Karachi and within one kilometre from the Arabian Sea, several kite flights were made preliminary to a more detailed investigation of the upper air in India by means of kites. The kites were fitted with meteorographs and some of the results of the actual flights are here epitomized :—

- (1). The highest flight occurred on August 28th, when an altitude of 1,380 metres was reached.
- (2). A nearly saturated stratum of air from the sea extended from the ground 10 metres above sea level, upwards to an altitude of 500 metres on August 27th, 800 metres on August 28th, 1,130 metres on August 31st, and 600 metres on September 12th.

* An abstract from an account of the preparations made for determining the conditions of the upper air in India by means of kites.

Memoirs of the Indian Meteorological Department; Vol. XX., Part 1; Calcutta. Published under the direction of Gilbert T. Wheeler, M.A., Sc.D., F.R.S., Meteorological Reporter to the Government of India.

[We regret that this notice has been standing in type for a very long time, but on the principle of "better late than never," we think it would be worse to cancel it than to print it.—ED. M.M.]

- (3). Above the nearly saturated stratum a very dry wind of relative humidity about 10 per cent. was encountered; as the zero of the humidity scale of the meteorograph changed rapidly as the kite entered this dry current some uncertainty, however, attached to the actual readings in the current, the uncertainty being estimated as representing an error of as much as 10 per cent.
- (4). This dry upper current, which was of land origin, exhibited at the levels reached by the kites very rapid diurnal variations of temperature, which are considered too great to be due to variations in the direct absorption of solar radiation.
- (5). The changes occurring in the dry upper land current were concluded to have been much larger and more rapid than those in the lower moist sea current.
- (6). It seems probable that the moist lower current was of the dimensions of a sea breeze, whereas the dry upper current formed part of a large air movement.

In this report coloured plates are produced indicating for the hours of 8 and 10 a.m. in August and September the normal wind directions and pressure distribution over the Indian Empire. From these it is seen that towards midday in August a well marked cyclonic circulation develops over the heated desert tracts of north-west India; but the most remarkable fact which the plates show is the relatively great change in the pressure distribution that occurs between 8 and 10 a.m., indicating how prominent diurnal changes are in tropical countries.

In our part of the world changes in the distribution of atmospheric pressure due to the time of day are so insignificant that they are completely obscured by those due to the time of year, but more especially by those which in our ignorance as to their causes we may describe as accidental.—L. C. W. B.

METEOROLOGICAL NEWS AND NOTES.

THE ROYAL METEOROLOGICAL SOCIETY organised an interesting Meteorological Exhibit in connection with the Agricultural Education and Forestry Section of the Royal Agricultural Society's recent Show at Lincoln. The exhibit was attractively arranged, and was intended to illustrate the Society's work in diffusing a knowledge of meteorology. Various patterns of self-recording and other instruments were shown, together with specimens of lightning conductors and objects damaged by lightning. Diagrams relating to rainfall, temperature, sunshine, the influence of weather on crops, health and such matters, and a collection of photographs illustrating meteorological phenomena were also exhibited. A fully equipped Climatological Station, with the various instruments in position, was arranged in a railed-off enclosure in the grounds, and lectures were given by Mr. W. Marriott on "Meteorology in Relation to Agriculture."

THE DEATH OF MR. J. M. PHILLPOTT, F.R.Met.Soc., on July 17th, removed the chief assistant in the office of *British Rainfall* and of this Magazine. Mr. Phillpott, after several years in the office of the Royal Meteorological Society, joined the staff of the British Rainfall Organization in November, 1899, a few months before the death of Mr. Symons, and he rapidly mastered the complicated details of the work, in which year by year he took an increasing share. Mr. Phillpott was a singularly accurate worker, and his keen interest in all that concerned meteorological work, combined with his pleasant unassuming manner, made him a valued friend of everyone with whom he worked. Much of his work was in connection with this Magazine. Mr. Phillpott, who was 34 years of age, leaves a widow and two young children.

TWO METEOROLOGICAL OFFICE APPOINTMENTS have been intimated. Mr. R. H. Curtis has been appointed Superintendent of the Instruments Branch, with which the Observatories Branch will be incorporated. Mr. Richard Corless, B.A., Sidney Sussex College, Cambridge, has been appointed Special Assistant to the Director.

THE INTERNATIONAL INVESTIGATIONS IN THE UPPER ATMOSPHERE, which are carried out monthly at the same time at the kite and balloon observatories in different parts of Europe, were conducted on an extended scale in the last week of July. On that occasion not only were observations made at the regular stations, but also at sea in various parts of the northern hemisphere, and at supplementary stations on shore. The Royal Meteorological Society and the Kite Committee of the British Association secured observations with free balloons at several stations, particulars of which we hope to give in an early number.

NEWSPAPER WRITERS, and even some scientific men, in calling attention to the causes of the very wet summer of 1907, have given reasons which in some cases seemed very convincing, only it so happens that the summer, or the year so far as it has gone, has not been very wet at all! Up to the end of July the rainfall for the British Isles as a whole was normal.

Errata.—In the supplementary table of rainfall last month the rainfall for June at Plynlimon was given as 1·53 in., the figure ought to have been 15·25 in., and as this is an exceptionally heavy fall, even at so wet a station, we should be glad if our readers would make the correction in their copies. Mr. Denning asks us to correct the date of the cold day mentioned on p. 111 in the July number, from "July 14th, 1876," which is an error, to "July 14th, 1875," which is corrected.

TEMPERATURE FOR JULY, 1907.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				No. of atmos.
					Max.		Min.		
					°	Date.	°	Date.	
Camden Square.....	London.....	51 32	0 8	111	80·7	15	42·3	11	0
Tenterden.....	Kent.....	51 4	0 41	190	74·5	15	42·0	11	0
West Dean.....	Hampshire.....	51 3	1 38	137	77·0	15, 20	38·0	11	0
Hartley Wintney.....	".....	51 18	0 53	222	82·0	20, 21	42·0	13	0
Hitchin.....	Hertfordshire.....	51 57	0 17	238	75·0	20	39·0	11	0
Winslow (Addington).....	Buckinghamsh.	51 58	0 53	309	78·0	19	38·0	11	0
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	0 40	226	75·5	27, 29	40·0	11	0
Brundall.....	Norfolk.....	52 37	1 26	66	73·2	29	40·2	23	0
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	78·8	17	39·0	8, 13	0
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	77·3	17	44·9	11	0
Polapit Tamar [Launceston].....	".....	50 40	4 22	315	57·9	26	36·1	11	0
Bath.....	Somerset.....	51 23	2 21	67	80·0	20	41·0	12	0
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	80·0	20	45·0	11	0
Church Stretton (Woolstaston).....	Shropshire.....	52 35	2 48	800	77·5	19	34·0	1, 2, 3	0
Coventry Kingswood.....	Warwickshire.....	52 24	1 30	340	75·0	20	43·0	3	0
Boston.....	Lincolnshire.....	52 58	0 1	25	75·0	16	40·0	11	0
Workshop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	75·7	16, 18	37·3	1	0
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	80·0	17, 18	38·0	11	0
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	77·1	17	39·6	1	0
Wetherby (Ribston Hall).....	Yorkshire, W.R.	53 59	1 24	130	...	...	...	...	...
Arncliffe Vicarage.....	".....	54 8	2 6	732	...	...	...	...	...
Hull (Pearson Park).....	" E.R.	53 45	0 20	6	76·0	28	40·0	11	0
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	81·7	18	41·5	2	0
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...
Haverfordwest (High Street).....	Pembroke.....	51 48	4 58	95	80·2	18, 20	42·5	12	0
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	85·0	20	33·0	10	0
Llandudno.....	Carnarvon.....	53 20	3 50	72	76·0	17	46·2	4	0
Cargen [Dumfries].....	Kirkcudbright.....	55 2	3 37	80	81·4	16	40·0	2, 11	0
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	...	...	...	...	...
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	77·1	16	42·8	7	0
Girvan (Pinmore).....	Ayr.....	55 10	4 49	207	84·0	17	41·0	1, 11	0
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	78·0	17	41·0	6	0
Tighnabruaich.....	Argyll.....	55 55	5 14	50	74·0	17	38·0	6	0
Mull (Quinish).....	".....	56 36	6 13	35	81·0	20	...	...	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	83·0	16	40·0	7	0
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...
Aberdeen (Cranford).....	".....	57 8	2 7	120	74·0	15, 16	40·0	6	0
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130?	...	...	...	...	...
Loch Torridon (Bendamph).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	69·0	16	42·0	9	0
Castletown.....	Caithness.....	58 35	3 23	100	74·0	15	36·0	18	0
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	85·0	19	39·0	11	0
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	80·0	17, 18	39·0	5	0
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	81·0	22	40·0	10	0
Abbey Leix (Blandsfort).....	Queen's County.....	52 56	7 17	532	80·0	19	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	77·3	17	43·8	11	0
Ballinasloe.....	Galway.....	53 20	8 15	160	85·2	17	36·0	2	0
Cliffen (Kylemore House).....	".....	53 32	9 52	105	...	...	...	...	...
Crossmolina (Enniscoe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...
Seaforde.....	Down.....	54 19	5 50	180	88·0	17	40·0	10	0
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	...	...	...	...	...

RAINFALL FOR JULY, 1907.

RAINFALL OF MONTH.						RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.	
No.	1907. in.	Diff. from Av. in.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99. in.	1907. in.	Diff. from Aver. in.			% of Av.
				in.	Date.							
1	1.96	— .53	79	.61	22	15	13.12	12.00	— 1.12	91	25.16	Camden Square
2	1.20	— 1.06	53	.32	30	14	13.81	11.36	— 2.45	82	28.36	Tenterden
3	1.45	— 1.17	55	.47	21	13	15.23	12.20	— 3.03	80	29.93	West Dean
4	1.47	— .91	62	.46	21	14	13.97	12.95	— 1.02	93	27.10	Hartley Wintney
5	1.82	— .73	71	.36	10	17	12.81	12.82	+ .01	100	24.66	Hitchin
6	1.94	— .83	70	.52	4	15	14.05	13.06	— .99	93	26.75	Addington
7	1.76	— 1.15	60	.56	10	13	13.23	13.97	+ .74	106	25.39	Westley
8	1.30	— 1.40	48	.51	30	12	12.82	14.87	+ 2.05	116	25.40	Brundall
9	1.27	— 1.51	46	.29	3	12	19.14	16.18	— 2.96	85	39.00	Winterbourne Stptn
10	1.98	— .75	73	.88	2	16	17.78	15.18	— 2.60	85	35.00	Torquay
11	1.56	— 1.37	53	.35	2	16	18.38	17.27	— 1.11	94	38.85	Polapit Tamar
12	4.80	+ 1.97	170	2.69	21	14	15.86	16.92	+ 1.06	107	30.75	Bath
13	4.33	+ 1.43	149	2.18	22	16	15.73	15.68	— .05	100	29.85	Stroud
14	3.08	+ .42	116	.54	22	19	16.97	17.94	+ .97	106	33.04	Woolstaston
15	2.96	+ .21	108	.83	21	17	15.31	15.10	— .21	99	29.21	Coventry
16	1.61	— .83	66	.25	22	13	12.20	11.20	— 1.00	92	23.30	Boston
17	1.43	— 1.08	57	.38	10	16	13.32	11.80	— 1.52	89	24.70	Hodsock Priory
18	2.67	+ .04	102	.71	21	18	14.11	15.78	+ 1.67	112	26.18	Derby
19	3.77	— .35	91	.90	21	21	20.87	26.51	+ 5.64	127	42.43	Bolton
20	1.77	— .84	68	.49	30	18	14.24	14.83	+ .59	104	26.96	Ribston Hall
21	3.15	— 1.82	63	.37	8, 26	20	31.44	36.21	+ 4.77	115	60.96	Arncliffe Vic.
22	1.41	— 1.09	56	.23	5, 8	14	13.74	13.71	— .03	100	27.02	Hull
23	1.74	— 1.17	60	.25	3, 29	17	14.26	13.68	— .58	96	27.99	Newcastle
24	4.28	— 5.09	46	1.18	7	15	66.73	67.46	+ .73	101	132.68	Seathwaite
25	2.66	— .86	76	.60	4	17	20.71	19.46	— 1.25	94	42.81	Cardiff
26	2.17	— 1.53	59	.45	24	16	23.37	21.09	— 2.28	90	47.88	Haverfordwest
27	4.44	+ .17	104	.75	4	15	21.86	25.49	+ 3.63	117	45.41	Gogerddan
28	2.28	— .33	87	.63	24	16	14.79	12.84	— 1.95	87	30.98	Llandudno
29	1.71	— 1.59	52	.38	12	13	22.05	26.00	+ 3.95	118	43.43	Cargen
30	...	...	...	...	...	...	17.14	...	...	...	33.04	Riddell House
31	2.49	...	...	.77	4	14	...	12.64	...	...	...	Edinburgh
32	3.21	— .39	89	1.08	12	19	24.12	...	...	...	48.87	Girvan
33	2.80	— .56	83	.73	12	15	18.30	21.78	+ 3.48	119	35.80	Glasgow
34	5.01	+ .68	116	1.67	12	14	28.98	33.78	+ 4.80	117	57.90	Tighnabruaich
35	2.83	— 1.55	65	.95	12	17	28.22	27.76	— .46	98	57.53	Quinish
36	2.30	— .73	76	.75	7	18	15.12	16.30	+ 1.18	108	28.95	Dundee
37	1.65	— 1.24	57	...	...	...	17.83	17.45	— .38	98	36.07	Braemar
38	1.88	— 1.14	62	.43	7	16	16.71	16.84	+ .13	101	33.01	Aberdeen
39	2.65	— .69	79	.44	9	12	15.26	18.12	+ 2.86	119	29.37	Cawdor
40	2.48	— 1.30	66	.60	12	11	28.50	34.10	+ 5.60	120	56.00	Invergarry
41	5.11	— 1.35	79	.75	10	18	42.50	55.37	+ 12.87	130	86.50	Bendamp
42	1.57	— 1.25	56	.33	9	12	16.27	20.11	+ 3.84	124	31.60	Dunrobin Castle
43	1.19	...	...	.20	4	19	...	18.05	...	...	...	Castletown
44	2.32	— 1.67	58	.37	3	19	29.98	21.30	— 8.68	71	58.11	Killarney
45	3.04	— .06	98	1.26	24	16	20.29	18.62	— 1.67	92	39.30	Waterford
46	2.51	— .43	85	.53	13	18	17.06	18.61	+ 1.55	109	33.47	Hurdlestown
47	4.19	+ 1.14	137	.85	22	20	18.25	19.86	+ 1.61	109	35.19	Abbey Leix
48	2.02	— .61	77	.46	3	19	14.51	14.35	— .16	99	27.75	Dublin
49	2.89	— .42	87	.52	22	22	19.23	20.65	+ 1.42	107	37.04	Ballinasloe
50	4.16	— 1.99	68	1.02	3	13	40.44	35.19	— 5.25	87	80.23	Kylemore House
51	2.43	— 1.16	68	.48	10	20	25.33	28.58	+ 3.23	113	50.50	Enniscoe
52	2.23	— 1.17	66	.40	2, 12	13	20.32	22.85	+ 2.53	112	38.61	Seaforde
53	3.84	+ .37	111	.90	12	19	20.54	29.74	+ 9.20	145	41.20	Londonderry
54	...	...	...	...	...	...	10.25	...	...	...	37.85	Omagh

SUPPLEMENTARY RAINFALL, JULY, 1907.

Div.	STATION.	Rain inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	1.65	XI.	Rhayader, Tyrmynydd	4.72
"	Ramegate	1.69	"	Lake Vyrnwy	3.55
"	Hailsham	1.42	"	Llangyhanfal, Plas Draw	2.10
"	Crowborough, Uckfield Lodge	2.24	"	Criccieth, Talarvor	1.84
"	Totland Bay, Aston House	1.45	"	Llanberis, Pen-y-pass	5.53
"	Emsworth, Redlands	1.55	"	Lligwy	2.00
"	Alton, Ashdell	2.35	"	Douglas, Woodville	1.81
"	Newbury, Welford Park	2.37	XII.	Stoneykirke, Ardwell House	2.42
III.	Harrow Weald, Hill House	3.06	"	Dalry, The Old Garroch	2.77
"	Oxford, Magdalen College	2.07	"	Langholm, Drove Road	2.76
"	Bloxham Grove	2.46	"	Moniaive, Maxwellton House	1.85
"	Pitsford, Sedgebrook	1.93	XIII.	N. Esk Reservoir [Penicuik]	3.35
"	Huntingdon, Brampton	2.10	XIV.	Maybole, Knockdon Farm	2.25
"	Wisbech, Bank House	1.02	XV.	Campbeltown, Witchburn	3.00
IV.	Southend Water Works	2.59	"	Inveraray, Newtown	3.56
"	Colchester, Lexden	2.26	"	Ballachulish House	3.70
"	Newport, The Vicarage	2.36	"	Islay, Eallabus	3.72
"	Rendlesham	1.74	XVI.	Dollar Academy	3.19
"	Swaffham	1.50	"	Loch Leven Sluice	2.50
"	Blakeney	2.30	"	Balquhider, Stronvar	2.34
V.	Bishops Cannings	2.73	"	Perth, Pitcullen House	2.34
"	Ashburton, Druid House	3.37	"	Coupar Angus Station	2.36
"	Okehampton, Oaklands	1.60	"	Blair Atholl	1.66
"	Hartland Abbey	1.32	"	Montrose, Sunnyside Asylum	2.02
"	Lynmouth, Rock House	1.94	XVII.	Alford, Lynturk Manse	3.39
"	Probus, Lamellyn	1.73	"	Keith Station	1.39
"	Wellington, The Avenue	1.88	XVIII.	N. Uist, Lochmaddy	1.72
"	North Cadbury Rectory	2.72	"	Alvey Manse	2.24
VI.	Clifton, Pembroke Road	2.14	"	Loch Ness, Drumnadrochit	4.19
"	Ross, The Graig	2.51	"	Glencarron Lodge	2.56
"	Shifnal, Hatton Grange	2.80	"	Fearn, Lower Pitkerrie	1.33
"	Cheadle, The Heath House	3.10	XIX.	Invershin	1.64
"	Blockley, Upton Wold	2.54	"	Altnaharra	1.29
"	Worcester, Boughton Park	2.72	XX.	Bettyhill	2.17
VII.	Market Overton	1.88	"	Dunmanway, The Rectory	2.20
"	Market Rasen	2.21	"	Cork	2.36
"	Bawtry, Hesley Hall	2.04	"	Darrynane Abbey	2.58
VIII.	Neston, Hinderton Lodge	1.78	"	Glenam [Clonmel]	3.27
"	Southport, Hesketh Park	2.43	"	Ballingarry, Gurteen	3.38
"	Chatburn, Middlewood	2.89	"	Miltown Malbay	3.23
"	Cartmel, Flookburgh	2.34	XXI.	Gorey, Courtown House	2.28
IX.	Langsett Moor, Up. Midhope	1.03	"	Moynalty, Westland	1.83
"	Scarborough, Scalby	1.69	"	Athlone, Twyford	2.16
"	Ingleby Greenhow	2.21	"	Mullingar, Belvedere	3.71
"	Mickleton	2.28	XXII.	Woodlawn	2.88
X.	Bardon Mill, Beltingham	2.39	"	Westport, Murriak Abbey	2.89
"	Ewesley, Fallowles	1.83	"	Collooney, Markree Obsy	...
"	Ilderton, Lilburn Cottage	3.30	"	Mohill	1.40
"	Keawick, York Bank	5.54	XXIII.	Enniskillen, Portora	3.12
XI.	Llanfrecfa Grange	2.94	"	Warrenpoint, Summer Hill	2.92
"	Treherbert, Tyn-y-waun	1.78	"	Banbridge, Milltown	3.24
"	Carmarthen, The Friary	7.20	"	Belfast, Springfield	2.64
"	Castle Malgwyn [Llechryd]	3.60	"	Bushmills, Dundarave	4.06
"	Plynlimon	3.71	"	Stewartstown, The Square	2.76
"	Crickhowell, Ffordlas	...	"	Killybegs	...
"	New Radnor, Ednol	...	"	Horn Head	...

METEOROLOGICAL NOTES ON JULY, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Cool and cloudy throughout; the max. shade temp. touched 80° on one day only, and failed to reach 70° on 17 occasions. Mean temp. 60°·1, or 3°·2 below the average. Duration of sunshine 162·6* hours, and of R 23·8 hours. Sharp TS on 10th, and heavy T on 22nd.

CROWBOROUGH.—Unseasonable weather with unusually low temp., and only an occasional warm day. Mean temp. 57°·1, or 4°·4 below the average. R 49 in. below the average of 36 years. Several TSS, severe on 22nd and 30th.

HARTLEY WINTNEY.—Cloud and low temp. prevailed throughout, and there was no summer weather. The rough wind of June continued till 10th.

TORQUAY.—Duration of sunshine 236·6* hours, or 11·0 hours above the average. Mean temp. 58°·9, or 2°·9 below the average.

CLIFTON.—Very wet and cold till 8th, but fine and hot from 11th to 20th. Heavy TS on 21st, and afterwards dull and cool. R 22 in. below the average.

STROUD.—Severe TSS on 21st and 22nd. On the latter day 1·16 in. fell between 3 and 4.30 p.m., and another 1·00 in. from 4.30 to 5.30 p.m. A heifer was killed by L, and a belfry in Stroud and a tree close by were struck.

WORCESTER.—About ten days of fine weather from 10th, with temp. well above 80° from 15th to 21st, but otherwise cool and stormy, with cold nights. Severe TS on 21st, and two houses struck by L.

BOLTON.—Generally very unsettled with low temp. The only summer-like weather was between 11th and 19th, when most of the sunshine was recorded. Mean temp. 55°·2, or 1°·3 below the average. Duration of sunshine 109·8* hours, or 42·9 hours below the average. Severe TS on 21st.

SOUTHPORT.—Dry and normally sunny, yet, but for a warm period during the third week, unusually cold. Mean temp. 57°·7, or 2°·0 below the average. Duration of sunshine 213 hours, or 1 hour above the average. R 1·21 in. below the average, but subsoil water and brooks were at an exceptionally high level. Duration of R 36·0 hours. TSS on 4th, 21st and 22nd, the last occasioning serious damage.

ABERYSTWYTH.—Heavy R from 1st to 9th, with little sun; splendid weather from 9th to 22nd, after which it completely broke up.

DOUGLAS.—Dry and quiet, and a great improvement on the previous months, although unseasonably cold in the first fortnight and last week. Beautiful summer weather with high temp. from 14th to 23rd.

DUMFRIES.—The wet weather of June continued till 12th, when dry warm weather succeeded, effecting a marvellous change in farm and garden.

MULL, QUINISH.—The cold sunless weather ended abruptly with heavy R on 12th, and the following 11 days of sunshine and heat entirely altered the agricultural situation, so that the year promised to be a good one.

COUPAR ANGUS.—R 59 in. above the average; and mean temp. 56°·6, or 0°·7 below the average. With the exception of five days from 13th, it was like May and June, both cold and wet.

DRUMADROCHIT.—R 58 in., and rain days 2, below the average of 21 years.

MILTOWN MALBAY.—Until St. Swithin's day it was unnaturally cold and rainy, but this ended with heavy R on 12th and 13th, and torrid heat continued almost to the end.

DUBLIN.—Cold and broken at first, but warm from 12th to 21st, and thundery from 20th to 22nd; afterwards unsettled, showery and gusty. Mean temp. 59°·6, or 0°·9 below the average.

BANBRIDGE.—On 19th H stones fell six inches in circumference, and weighing more than an ounce each.

* Campbell-Stokes.

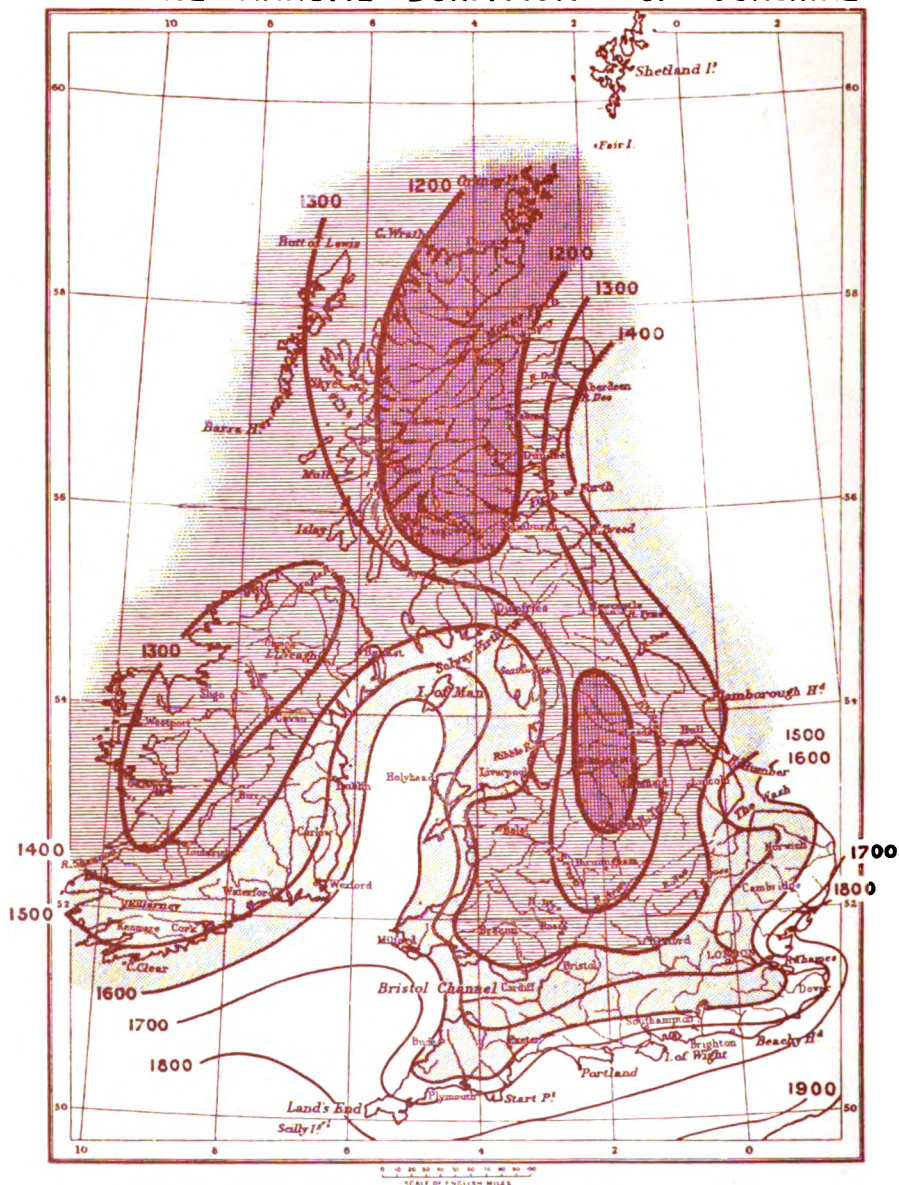
Climatological Table for the British Empire, February, 1907.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Max. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
London, Camden Square	52°0	17	25°4	24	43°0	32°7	34°4	87	80°1	20°9	inches 1·17	13	...
Malta	...	...	...	...	...	...	...	...	...	...	...	...	...
Lagos	96°0	15	71°0	13	88°1	75°9	75°0	77	151°0	67°5	·20	4	6·7
Cape Town	89°8	4	54°7	20	78°4	60°5	59°0	71	...	...	·23	5	3·3
Durban, Natal	90°0	19	64°1	14	84°1	69°6	...	...	147°2	...	4·06	16	1·1
Johannesburg	79°9	9	51°8	14	73°1	56°4	57°2	82	158°4	49°5	6·25	15	5·4
Mauritius	88°3	2*	67°0	1	85°8	72°2	69°4	74	151°2	61°4	2·75	15	6·4
Calcutta... ..	88°0	27	51°4	10	82°6	61°5	59°6	67	146°9	45°0	·09	1	2·8
Bombay... ..	88°7	28	63°3	1	83°7	69°9	65°0	69	132°1	54°9	·27	1	0·4
Madras	91°4	24	63°6	13	86°2	68°4	68°6	77	142°0	63°4	·00	0	2·0
Kodaikanal	72°0	13	44°9	10	67°6	47°6	42°2	59	130°3	30°3	·00	0	2·6
Colombo, Ceylon	92°4	9	70°2	14, 15	87°6	72°8	70°5	73	151°8	64°0	3·85	7	3·3
Hongkong	67°8	28	46°7	21	61°3	55°2	51°2	75	125°5	...	·17	2	8·0
Melbourne	103°8	25	45°2	10	75°3	53°8	50°7	64	154°6	38°1	·66	3	3·8
Adelaide	105°2	24	50°0	13	88°8	63°1	50°4	40	154°7	43°4	·19	3	2·5
Coalgardie	106°5	2	52°0	17	90°7	63°5	55°3	48	176°9	49°5	·98	3	2·6
Sydney	88°0	14	59°9	19	76°9	63°8	60°6	71	127°5	50°2	2·57	16	6·1
Wellington	77°2	16	49°4	27	69°3	57°9	54°6	73	128°0	40°0	3·94	9	6°0
Auckland	78°0	8	56°0	25	72°9	61°1	55°7	65	144°0	52°0	5·79	10	5·3
Jamaica, Negril Point.	85°9	24	61°0	2	83°0	66°6	65°1	72	...	...	·68	4	...
Trinidad	91°0	14	63°0	1	85°3	66°8	63°3	77	160°0	61°0	·44	5	...
Grenada	87°0	9	69°0	5	82°7	71°1	67°9	72	152°0	...	2·54	18	3°0
Toronto	41°0	13	- 6°1	12	26°1	10°2	12°7	81	49°0	-11°5	·15	3	6·2
Fredericton	39°0	14	-25°5	24	20°0	-2°9	...	77	...	...	·00	0	5·2
St. John's, N.B.	43°3	15	-11°3	23	25°2	6°2	...	...	...	...	1·07	2	5·6
Victoria, B.C.	53°1	19	25°5	3	46°4	37°0	...	...	...	...	3·89	14	7·7
Dawson	45°0	15	-55°0	22	-18°2	-34°1	...	...	...	...	·00	0	5·5

* and 16, 26.

Johannesburg.—Bright sunshine 199·9 hours.*Mauritius.*—Mean temp. of air 0°·3, dew point 1°·5, relative humidity 3·5 per cent., and R 3·90 in. below, averages. Mean hourly velocity of wind 8·5 miles, or 2·5 below average.*MADRAS.*—Mean temp. of the air slightly above the average.*KODAIKANAL.*—Bright sunshine 249 hours.*COLOMBO.*—Mean temp. of air 80°·2 or same as average, of dew point 70°·5 or same as average, and R 1·74 in. above average. Mean hourly velocity of wind 6·3 miles.*HONGKONG.*—Mean temp. of air 58°·7. Bright sunshine 96·5 hours. R 1·70 in. below average. Mean hourly velocity of wind 15·3 miles.*Adelaide.*—Mean temp. of air 2°·0 above, and R ·41 in. below, averages.*Sydney.*—Mean temp. of air 0°·7 below, and R 2·11 in. below, averages.*Wellington.*—Mean temp. of air 1°·2 above, and R ·60 in. above averages.*Auckland.*—Mean temp. of air close to average. Rainfall largely in excess of average.

AVERAGE ANNUAL DURATION OF SUNSHINE



By RICHARD H. CURTIS.

Symons's Meteorological Magazine, Vol. 42.

[Face p. 150.]

Symons's Meteorological Magazine.

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THE DISTRIBUTION OF BRIGHT SUNSHINE OVER THE BRITISH ISLES.

By RICHARD H. CURTIS.

BEFORE proceeding to discuss the average distribution of "bright" sunshine over the British Islands, it may be useful to try first of all to define what "bright sunshine" is. At first sight this may appear to be a very simple matter, but, as a matter of fact, in this as in many similar cases the question is more easily asked than answered.

At the outset we are met with a difficulty, arising from the fact that the sun's rays present a complex phenomenon about which there is still a good deal to learn. They differ very much in wave-length, and, therefore, the effects they are capable of producing are very varied also; and it must be remembered that it is only by their effects that the different rays can be identified and their intensity measured. Besides this, the number of rays of a given wave-length appears to bear no fixed relation to the number of rays of any other wave-length, but on the contrary their proportions are constantly changing, owing to the process of absorption to which the rays become subjected when they enter the atmosphere. The extent to which this absorption occurs depends upon the humidity of the air, and even more upon the presence of dust particles, by which the rays of shorter wave-length are stopped, while the longer ones continue to pass more or less freely. The dust particles also form nuclei for the condensation of the aqueous vapour, and when water becomes deposited upon them their obstructive power is greatly increased, until the point being reached at which a cloud is formed no *direct* solar rays can pass at all.

In dealing with the rays emitted by the sun, we may regard them from three points of view: we may consider the amount of light they bring us, or their heat, or the energy of their chemical action. For meteorological purposes, the most important solar radiations are without doubt the heat rays, for it is they that chiefly, if not entirely, affect the movements of our atmosphere. The chemical, or actinic, rays, and also the light rays, play an important part in the economy of animal and vegetable life, and so come within the scope of applied meteorology, and, therefore, they too ought to be included in any

record purporting to completely represent the sun's radiations. Up to now, however, no instrument has been devised which will satisfactorily supply such a complete record; and, therefore, when we wish to register the intensity of the solar action, we have first to decide whether for the particular purpose in view it is most desirable to record the intensity of the solar *heat*, or of the sun's *light*, or of its *actinic* rays.

For some years meteorological observers were somewhat divided upon the relative merits of the first and third of these groups; less probably because they had any doubt as to which was, meteorologically, the more important, than because the record of the actinic rays could be more easily got, and also, perhaps, some may have thought that those rays afforded a truer approximation to the intensity of the whole solar radiation than the record of solar heat could supply.

Two forms of recorder have, therefore, been in use for recording "bright sunshine":—one in which the intensity of the actinic radiation is recorded by means of photography; the other a "burning" recorder, in which the focussed heat rays write their record upon a strip of card.

As might be expected from what has just been said, these two records frequently differ a good deal from each other, and the difference is not always in the same direction. Sometimes it is the photographic recorder which registers the greater record, and at other times its record is considerably less than that of the burning recorder. The opinion was at one time rather generally held that the photographic record *always* exceeded the other; but that idea was based chiefly upon some very unsatisfactory figures, published some ten or twelve years ago, as the result of a comparison which has been shown to have been worthless.* Since then, several prolonged comparisons of the records by the two styles of instrument have been carried out, and the general result has been to show that the differences from day to day nearly balance each other over the longer period of a month, and that the yearly amounts of bright sunshine recorded by both are practically alike.†

For the sake of uniformity, however, and in order that records from all places however widely separated, and for short as well as for long periods, may be satisfactorily compared, it became necessary to decide finally which of the two forms of recorder should be adopted as the standard for meteorological purposes, and Dr. Shaw, F.R.S., the Director of the Meteorological Office, has decided that for the official publications of his department, and from the beginning of the year 1906, only the records of the burning recorder shall be employed.

Briefly described, the burning recorder consists of a sphere of

* See *Quart. Journ. Roy. Met. Soc.*, Vol. 24, p. 1.

† Such comparisons have been made by Mr. March, F.R.Met.Soc., at Torquay; Mr. Cresswell, at Edgbaston; and especially by Mr. Baxendell, F.R.Met.Soc., at Southport.

crown glass, four inches in diameter, which is placed upon a pedestal centrally in a metal frame designed to carry a strip of coloured card. The sun's rays passing through the lens are focussed upon the card, and if the heat rays are of sufficient intensity they burn it, the burn varying from a faint discoloration with weak sunshine to a clean burn right through the card when the sun shines with greater force.

Here then we reach a definite standard, which enables us to give an arbitrary, but at the same time a perfectly reasonable, definition of "bright sunshine," which may be defined as beginning when the radiation of solar heat beams sufficient to at least char a strip of coloured card, after the sun's rays have been passed through a spherical lens under the conditions just described. It is the direct solar radiation covered by this definition, whose distribution over the British Isles I now proceed to discuss.

The sunshine recorder first took its place as a meteorological instrument for general use in the year 1880, and there are now available more than twenty-five years' observations for a few places, and series covering shorter periods for a large and steadily increasing number. There are, however, unfortunately still many parts of the Kingdom for which at present no data are forthcoming. In constructing the map which accompanies this article, I have used the averages published by the Meteorological Office, to which I have added others which have been derived from various sources, weighting them as far as possible for the length of the period they cover.

There are two ways in which the records of bright sunshine may be dealt with:—we may consider the actual number of hours recorded, or we may regard that number as a percentage of the time during which the sun remained above the horizon of the place of observation; or, in other words, as a percentage of the total amount of sunshine possible, supposing the sun to have been shining without obstruction from sunrise to sunset. Obviously, latitude is also an important factor in the record, because the heating power of the sun's rays is directly influenced by the sun's altitude; but so far it has not been customary to take this into account, nor to make any allowance for the obstruction of the sun's rays caused by physical features of the surrounding district, such as high hills; in the accompanying map the average number of hours recorded at the several stations has been used in drawing the "isohels."

The sunniest parts of the United Kingdom are the most southern, the annual total of hours' duration decreasing as we proceed northward, from 1,900 hours in the Channel Islands to only 1,200 hours over the north of Scotland. The lines of equal duration show, however, a strong tendency to follow the lines of the coast both in the east and the west, and this feature is well shown by the stations adjacent to the St. George's Channel. A large part of the central area of England, and of the south-west of Scotland, is adversely influenced by the smoke and dust of the large manufacturing centres, which becoming dispersed through the atmosphere to leeward screens

off a large percentage of the sun's heat rays, and of course the immediate neighbourhoods of these centres suffer most of all; the map is, however, too small to allow of their being specially indicated. To some extent the hilly, and therefore rainy, districts of the west show smaller sunshine totals than places on the eastern littoral in the same latitude; but this is indicated more in certain months than in others, and a heavy rainfall and large total of sunshine frequently occur at the same station, the explanation being that a large rainfall is not necessarily a prolonged one. Unfortunately, as has already been said, some portions of the Kingdom are still very inadequately represented by sunshine recorders, and for these regions the lines on the map are somewhat hypothetical; a great part of Ireland, Central Wales, and the Highlands of Scotland are such regions, but it is perhaps not too much to hope that in the next few years this defect will largely be removed.

Of the several months, May and June are the most sunny, and December is almost everywhere the least so. In winter, the largest totals of sunshine are obtained in the rainy south-west; and at that season of the year the effect of the ejecta from the towns is felt in their neighbourhoods more severely than at any other period, the lower altitude of the sun making it more difficult for its rays to penetrate the dusty screen they have to traverse before reaching the Earth. There are, however, many points of view from which the data given in the map might be discussed. The relation between the average duration of sunshine and the mean temperature, the range of temperature, the temperature of the soil, the cloudiness of the sky, and the prevalence of rain, are some of those which might be dealt with did space permit.

Total number of hours during which the sun is above the horizon in each month, and for the whole year; for each 2° of Latitude from 50° to 60°.

Months.	LATITUDE.					
	50°	52°	54°	56°	58°	60°
January	265	256	246	235	223	208
February	280	275	271	266	259	253
March	365	365	364	363	363	362
April	410	413	417	422	427	432
May	474	483	491	501	513	526
June	487	497	509	523	539	558
July	491	501	511	524	538	555
August	447	453	459	466	473	482
September	379	380	382	383	385	387
October	334	331	327	323	319	315
November	272	265	258	249	239	227
December	251	241	229	216	202	184
YEAR	4455	4460	4464	4471	4480	4489

The foregoing Table gives the total possible duration of sunshine for every month, and for each two degrees of latitude from 50° to 60° . Some of our readers may desire to express their monthly results as percentages of these possible amounts, which may readily be done by dividing the recorded monthly total by the number in the Table corresponding to the month and the latitude of the station.



THE BRITISH ASSOCIATION AT LEICESTER.

(SECOND ARTICLE).

THE following Abstracts and Reports are all the available material provided by Section A for the assistance of the Press in following the meteorological discussions which took place at the meeting.

Examples of the Modern Methods of Treating Observations. By W. Palin Elderton.

This communication dealt with the application of recognised statistical processes to meteorological statistics. The terms *mean*, *median*, and *mode* were defined, and the methods of calculating their values given, with examples from rainfall statistics. The "*method of moments*" was described, and as an application a parabolic curve was fitted to statistics of rainfall in the east of England. The *standard deviation* was then explained, and it was pointed out that this function measures the way the observations are scattered about their mean. The importance of calculating a "standard deviation" or a "probable error" corresponding with means was then insisted on; the mere statement of a mean is statistically insufficient and of no use for comparative purposes until we know what deviations from the calculated value may arise.

The remainder of the communication dealt with correlation. The coefficient of correlation was first explained, and it was shown how it can be calculated. The rainfall in the east of England was compared with that in the north of Scotland and in the Channel Islands: in the former case the coefficient of correlation is very small, and about equal to its probable error, so that we cannot conclude that there is any correlation; but in the latter case the coefficient is found to be $\cdot 374 \pm \cdot 065$, and indicates that there is a distinct connection between the rainfall in the east of England and that in the Channel Islands. Another example taken was rainfall and typhoid cases in Surrey districts, the water supply of which is obtained from river sources. The coefficient of correlation is $\cdot 116$, with a probable error of $\cdot 073$, so that it is impossible to assert definitely that there is any relation between rainfall and typhoid—at any rate on the evidence afforded by these statistics. Reference was made to a paper on

barometric heights by Professor Karl Pearson, F.R.S., and Dr. Alice Lee, and to the use of the coefficient of correlation by Dr. Gilbert T. Walker, F.R.S., in his interesting memoranda on the meteorology of India.

The author concluded with an appeal for the more scientific treatment of statistics by modern methods.

An Analytical Study of the Meteorological Observations made at the Glossop Moor Kite Station during the Session 1906-1907. By Margaret White, T. V. Pring and J. E. Petavel, F.R.S.

In *Part I.* the change of temperature with height is considered. The rate of fall, or temperature gradient, is measured in degrees centigrade per hundred metres. The average gradient for the present year is given for the various English stations at each successive 500 metres above sea level. The values for Glossop Moor are 1.24° C., 0.91° C., 0.61° C. and 0.33° C., per 100 metres at heights of 400, 750, 1250, and 1750 metres. These results are compared with the observations made in previous years in America at Blue Hill, and in Europe at Berlin, Oxshott, and Crinan.

The temperature gradient varies: (1) with the wind direction, and is at all levels a maximum for a N.W. wind; (2) with the amount of clouds, and is at all levels a maximum on clear and fine days; (3) with the wind velocity, and is a maximum for low velocities.

Tables and diagrams illustrating these facts are included in the paper.

Part II. deals with the question of wind velocity. The average velocity is calculated for all stations at ground level, 500, 1000, and 1500 metres. For Glossop Moor the averages are 13, 26, 30, and 33 miles per hour respectively at these heights. Except at the ground level where it is influenced by local conditions, the average wind velocity at each height differs but little from station to station.

Comparing the velocities at various heights it is found that above a height of 500 metres the average increase is 0.6 mile per hour per 100 metres difference of level.

Curves showing the connection between the wind velocity and barometric gradient are given.

The effects of the absolute barometric height, of the season of the year and the wind direction, are also considered.

With regard to the alteration of wind direction with height, the results usually indicate a slight rotation in a clockwise direction, i.e., a west wind tends to become more northerly, &c.

A number of subsidiary questions, such as the conditions prevailing during temperature inversions, the occurrence of vertical air currents, and a general discussion of the hygrometric observations, are included in the paper.

Investigation of the Upper Atmosphere by Means of Kites in co-operation with a Committee of the Royal Meteorological Society.—Sixth Report of the Committee, consisting of Dr. W. N. Shaw (Chairman), Mr. W. H. Dines (Secretary), Mr. D. Archibald, Mr. C. Vernon Boys, Dr. R. T. Glazebrook, Dr. H. R. Mill, Professor A. Schuster, and Dr. W. Watson. (Drawn up by the Secretary).

Meetings of the Joint Committee were held on November 13th, 1906; also on January 24th, May 9th, May 23rd, and July 5th, 1907. Observations have been made by Mr. J. E. Petavel, F.R.S., at Glossop Moor, whose report on the subject is appended.

The Committee have had under consideration a circular sent out by Professor Hoesegell, the President of the International Aeronautical Commission. In it he asks for the co-operation of England in a special series of kite and balloon ascents, and the Committee have arranged for some ascents, in addition to those undertaken by the Meteorological Office, on the specified days.

At the meeting of the Joint Committee held on May 9th it was suggested that the British Association Committee should ask for re-appointment and for a grant of £25.

Glossop Moor Kite Station (Peak District). Report for the Session 1906-1907. By J. E. Petavel, F.R.S.

This kite station was established in the spring of 1906 by Mr. G. C. Simpson.

The necessary winding gear was purchased by aid of a grant from the Royal Meteorological Society; the other initial and current expenses have been defrayed by the Manchester University.

During the present session some sixty successful ascents have been made, Messrs. T. V. Pring and W. A. Harwood having kindly acted as voluntary assistants.

Miss Margaret White has undertaken an analytical study of the records obtained, and proposes to give a short account of the results of the work at the coming meeting of the British Association.

Recently the Government Grant Committee of the Royal Society have awarded the funds required to complete and perfect the apparatus installed at this station.

Meteorological Observations on Ben Nevis.—Report of the Committee, consisting of Lord McLaren (Chairman), Professor Crum Brown (Secretary), Sir John Murray, Professor F. W. Dyson, and Mr. R. T. Omond.

As mentioned in the report for 1905, the meteorological observations on Ben Nevis have now ceased, but the Committee have co-operated with the Scottish Meteorological Society in the discussion of the observations made on Ben Nevis and at Fort William during the twenty-one years that the observations were carried on. This discussion was conducted under the direction of the late Dr. Alexander

Buchan, but owing to his death on May 13th last no report can be furnished this year. It is proposed that the discussion be continued by Mr. Omond and others during the ensuing year.

The observations made at the high and low level observatories from the opening of the Ben Nevis Observatory in 1883 till the end of 1897 have been published, and those for two additional years—1898 and 1899—are in type. The observations to the end of 1887 were published by the Royal Society of Edinburgh. The cost of printing those of the succeeding twelve years—1888 to 1899 inclusive—has been defrayed by a grant of £500 from the Royal Society of London, and another grant of £500 from the Royal Society of Edinburgh. There still remain nearly five years' observations in manuscript, namely, from January, 1900, to September, 1904. The Committee consider it exceedingly desirable that these last observations should also be published, so that the whole record from the Ben Nevis Observatory be made available to meteorologists.

The estimated cost of printing these observations is £400, and towards this the Royal Society of Edinburgh has offered a grant of £200, spread over four years, on condition that the remainder of the money be obtained from other sources. The Royal Society of London has voted £50 for this object, so that there is still a sum of £150 required to make up the £400 necessary for the complete publication of the Ben Nevis records.

The Committee hope that the British Association will see its way to make up this deficiency by a grant from its funds, so as to enable the printing to go forward. The Committee beg to point out that it is some years since a grant was asked for the Ben Nevis work, and that at present there are no funds available for the purpose except what have been promised by the two scientific societies.

INTERNATIONAL INVESTIGATION OF THE UPPER ATMOSPHERE.

By WILLIAM MARRIOTT, F.R.Met.Soc.

DURING the last few years systematic attempts have been made to acquire information as to the meteorological conditions prevailing in the upper regions of the atmosphere. The method generally adopted has been to send up kites carrying meteorographs, which give records of the pressure, temperature and humidity. The direction in which the kite is flying shows the direction of the wind at that altitude, and the "pull" on the wire is an indication of the force of the wind.

In 1901, the Royal Meteorological Society and the British Association appointed a joint Committee to carry out such investigations in this country. The Committee were fortunate in securing the valuable co-operation and help of Mr. W. H. Dines, F.R.S., who kindly carried out the work, and also made the kites and winding

apparatus, and designed the light and simple meteorographs now in use. In the summers of 1902-3-4, kite ascents were made from specially chartered steamers off the west coast of Scotland. Mr. Dines continued the observations for the joint Committee at Oxshott until the Meteorological Office made the investigation of the upper atmosphere a branch of their work, and invited Mr. Dines to be superintendent of the work.

Mr. C. J. P. Cave has established a kite station at Ditcham Park, near Petersfield, where he has carried out numerous ascents. Mr. Salmon also has a kite station at Brighton.

Under the auspices of the joint Committee a kite station has been established, under the supervision of Prof. A. Schuster, F.R.S., at Glossop Moor, and the ascents have been carried out first by Dr. G. C. Simpson, and subsequently by Mr. J. E. Petavel, F.R.S. A summary of all the kite observations appears regularly in the "Weekly Weather Report" of the Meteorological Office.

The International Commission of Scientific Aeronautics, at their meeting last year at Milan, resolved to carry on during the years 1907 and 1908 a much more extended investigation of the upper atmosphere over the Northern Hemisphere than had hitherto been attempted. For this purpose, it was decided to supplement the kite observations by using pilot balloons (*ballons sondes*) to carry self-recording instruments, and also smaller balloons, the heights and drift of which were to be determined by two theodolites placed at the ends of a fixed base. The special ascents in 1907 were to be made on July 22nd to 27th, September 4th to 6th, and November 6th to 8th.

This scheme was heartily taken up by observers in most of the countries in the Northern Hemisphere. The Prince of Monaco proposed to make experiments in the far north; and the German Admiralty intended to send out a vessel fitted up for balloon ascents between Iceland and Norway. Another German expedition was also to be sent to the latitude of the Hebrides; while the French Admiralty intended sending out a vessel to the neighbourhood of the Azores. M. Teisserenc de Bort and Prof. A. L. Rotch also intended arranging ascents from their yacht, "Otaria," in the region of the trade winds and the doldrums.

With regard to the British Isles, the joint Kite Committee arranged for three stations, viz., at Sellack, in Herefordshire, under the charge of Capt. C. H. Ley; at Manchester University, under the charge of Mr. J. E. Petavel, F.R.S.; and at Trinity College, Dublin, under the charge of Prof. W. E. Thrift. The Meteorological Office also arranged for three stations, viz., Pyrton Hill, Oxon, and at Crinan, in Scotland, both under the supervision of Mr. W. H. Dines, F.R.S.; and at Ditcham Park, under the charge of Mr. C. J. P. Cave.

One or more balloons were sent up each day between July 22nd and 27th, from each of these stations. Twenty-four meteorographs

were sent up, some of which have been recovered. Two of those sent up from Manchester, reached a height of about 10 miles, and the lowest temperature recorded was about -58° F.

Unfortunately, low clouds prevailed during most of the period over which the experiments were carried out, and so comparatively few trigonometrical measurements could be made of the heights and drift of the balloons.

As the cutting of the corn is now in full swing, and as shooting is soon to commence, may I ask those of your readers who are engaged in the same to keep a sharp look out for the little cylinders containing meteorographs, and to carefully handle them (so as not to vitiate the records), and to return them to the address given on the label, or to forward them direct to me at 70, Victoria Street, Westminster.

I may mention that the next special series of ascents will be from the 4th to 6th of September.

It is hoped that when all the observations have been collated and discussed, much valuable information will have been obtained regarding the meteorological conditions prevailing in the upper regions of the atmosphere over the Northern Hemisphere.

THE SUN AS A TWINKLING STAR.

By MISS C. O. STEVENS.

WITH the employment of a suitable screen of some woven fabric (such as canvas or linen) to shield the eye from a too-blinding glare of sunlight, direct naked-eye observations of the sun may be made which show that the sun, shining in a cloudless sky, presents the normal appearance of a twinkling star, only on a greatly enlarged scale. Attentive observation of the phenomena of "twinkling," associated by this means with the sun, confirms the conclusion that, in their origin, they are to be traced to the same causes exactly as provoke the normal scintillations of the stars.

But it is to be noted that certain characteristics of these phenomena are most readily and reliably to be observed only in association with observation of the sun, owing, doubtless, to the comparatively great diameter of the area of illumination that offers for the purposes of the observation.

Thus, the sun offers special advantages for study of the various characteristics, and the possible sources of the interferences, that affect the direct passage of light through the Earth's atmosphere.

In the case of the sun, the phenomena of "twinkling" resolve themselves into the sweeping across the line of sight of bands or waves of alternately greater or less illumination, in parallel formation, lying at right angles to the direction of their propagation, and observation has shown, that while their direction of movement is variable, it bears a constant relation to the directions of drift of the atmosphere prevailing at the time and place of observation, whether these contemporaneous conditions be determined by ordinary methods

(wind-vanes, kites, etc.), or whether they may *only* be determined by the more searching method of telescopic observation of the features of atmospheric distortion of the sun's limb.

In offering a solution of the phenomena of stellar scintillations, Montigny surmises the occurrence in the upper regions of the atmosphere of the passage, across the line of sight between the star and the observer, of transparent prisms of air. The physical reality of such prisms of clear air is, presumably, demonstrated in the photographic records of the sun, taken at the Royal Observatory, Greenwich, and elsewhere, which appear to testify to a waved, or billowed, configuration of the atmospheric strata, and even to testify to the variability of their formation in detail, as well as of their direction and rate of movement. In other words, the features of atmospheric distortion of the sun's limb vary concordantly with variations in the direction and force of drift of the overlying strata of the atmosphere at the place of observation.

Further confirmation of the same is supplied by recorded observations of "shadow bands" at times of total solar eclipse; and also in the familiar features of "rippled" cloud structures. It is again, and perhaps pre eminently, confirmed by the fact that (in spite of their visibility to the naked eye being theoretically denied) stellar scintillations are easily to be traced in the zenith, though at all times less easily here than at lower altitudes.

The direction of propagation of the "twinkling" waves is a delicate element to determine precisely by naked-eye observation of the sun, and requires, on the part of the observer, an absolutely fixed point of view, such as is only to be secured by the use of some kind of head-rest.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

GOLDEN MARCH DUST.

I MAY observe, with regard to recent correspondence in your pages, that March dust is "worth its weight in gold" in Western Austria also by common consent, and its golden value is apparent from the agricultural point of view. The ground for this belief is the warming of the soil, which takes place very rapidly on sunny days in March, and at that time of year warm soil is of greater importance to crops than high air temperature. If the soil remains cold the warmth of the air does little good; in fact, it often does harm by increasing evaporation, whilst the activity of the roots in the cold soil is insufficient to bring up moisture from below, and the plants get dried up. On the other hand, a wet April, and especially a wet May, is greatly valued by our farmers.

J. HANN.

Vienna, 19th August, 1907.

THUNDERSTORM OF 21st JULY, 1907, IN THE CARTMEL DISTRICT.

THE severe thunderstorm on Sunday, the 21st, was really a succession of thundershowers, and, so far as this district was concerned, its full force seemed to be expended at Grange, Lindale-in-Cartmel, and up the Winster valley on the border of Lancashire and Westmorland.

Sheep were killed on Hampsfell Farm, above Grange, and on land near Lindale. At Farnside, Crosthwaite, on the Westmorland side of the Winster, a ball of fire fell in the lot, 100 yards above the house, splitting the rock open for yards, which, with the loose stones about it, appeared to have been blasted. A valuable horse was found injured at the foot of the rock, but whether struck by lightning or frightened by the shock is not known; we understand it is improving nicely, although, no doubt, its value must in any case be somewhat reduced. None of the family at the house were injured, though they felt a slight shock.

At Carke we heard the thunder and saw flashes of lightning most of the afternoon and during the night. We had .22 in. of rain in the afternoon, and .42 in. came with thunder-showers during the night.

At Yew-barrow House, Grange, there were five separate thunderstorms between 3 p.m. on Sunday and 1 a.m. on Monday morning.

Rainfall in 24 hours at Flookburgh Lodge.....	.61 ins.
„ „ The Mount, Carke.....	.64 „
„ „ Holker Gardens.....	.66 „
„ „ Aynsome, Cartmel.....	1.17 „
„ „ Yew-barrow, Grange.....	2.23 „

During the same time we find that at Broughton-in-Furness there fell .65 in., and at Sawrey, near Hawkshead, .62 in.

W. R. NASH.

The Mount, Carke-in-Cartmel.

AUGUST SHOOTING STARS.

THOUGH these bodies are of cosmical origin and are now usually understood to belong to the purely astronomical branch of science, the fact that they are rendered luminous in our atmosphere, and consumed there, still justifies them in holding a place amongst meteorological phenomena. For this reason I send you a few brief notes of the return of the August shower of Perseids this year. It was already distinctly visible on August 4th and 6th, for a few bright meteors were seen during those nights which were directed from the usual point in Perseus. On August 10th the hourly number of shooting stars visible during the night increased from 25 to 45. On

August 11th the number varied from 15 to 36. On August 12th there was apparently a slight increase, the hourly numbers ranging from 23 to 50.

The place of the radiant point on August 10th was at $44^{\circ} + 56^{\circ}$, and on August 12th at $47^{\circ} + 57^{\circ}$. On the whole the shooting stars appeared to be rather smaller, and somewhat less abundant, than during a pretty conspicuous return of the shower.

Of meteors not belonging to the Perseid stream, a few very interesting examples were recorded. On August 10th, at 10.30 p.m., a bright meteor fell near Alpha Andromedæ from the direction of Cygnus, and on the same night at 11.6 p.m. a conspicuous slow-moving object sailed through the northern part of Cassiopeia, from the direction of Aquila.

Miss Irene Warner, of Horfield Common, Bristol, has kindly sent me notes of her observations on August 11th and 12th. Watching for two hours, between 9.25 p.m. and 11.40 p.m. on August 11th, she counted 56 meteors, of which 9 only belonged to showers other than the Perseids. On August 12th, in $2\frac{1}{2}$ hours between 9.15 p.m. and 0.20 a.m., she counted 49 meteors, and they were nearly all Perseids. A bright meteor was seen on August 12th at 10.55 p.m. It passed slowly along from Delta to Alpha Cygni, and left a bright yellow train. At about 11.12 p.m. a very large meteor burst out suddenly close to the radiant point of the Perseids, and moved to south-east, almost parallel with the stars Gamma, Alpha and Delta in Perseus. The meteor left a bright streak. It appears to have been also observed by Mr. Kenyon at Stockport, and Mr. Corder at Bridgwater, and its real height was from 79 to 44 miles. The middle of its course was vertically over Rugby. Mr. Kenyon describes the meteor as flashing out with a brightness equal to the moon.

Though the recent display failed to exhibit exceptional richness, it has furnished us with some new and interesting data, which may contribute to advance our knowledge of one of the most important meteoric streams with which we are acquainted.

W. F. DENNING.

Bristol, August 14th, 1907.

SUGGESTED TERMINOLOGY.

READING over once more the prefatory Report of "British Rainfall, 1905," it seems just worth while to offer for consideration respecting "Terminological exactitude," for a *succession of more than fourteen days on each of which rain fell*, this compound word, *rain-run*, or (as one word) *rainrun*.

J. FIRTH.

The Cemetery, Huddersfield, July 11th, 1907.

BRITISH RAINFALL, 1906.

THE annual volume, which brings to a focus the work of the great army of rainfall observers in Great Britain and Ireland, has just been published under the title of "British Rainfall, 1906. On the Distribution of Rain in Space and Time over the British Isles during the year 1906, as recorded by more than 4,000 Observers in Great Britain and Ireland, and discussed, with Articles upon various branches of Rainfall work, by Hugh Robert Mill. The Forty-sixth annual volume, with maps and illustrations. London: Edward Stanford, 12, 13 and 14, Long Acre, W.C. 1907."

The frontispiece is a coloured map, showing the variation of the rainfall of the British Isles in 1906 from the average of thirty years. By the use of deepening tints of blue for rainfall progressively more and more above the average, and deepening shades of red for rainfall more and more below the average, the wet and dry areas are made to stand out very clearly.

As usual the volume is divided into two parts. Part I. contains a report of the work of the Rainfall Organization and two original papers. One of these, by the Editor, gives a discussion of the great snowstorm of Christmas, 1906, based on special reports by nearly 2,000 observers in all parts of the country. Two maps illustrate the depth of snow and the hour at which the snowfall commenced. The latter is of particular interest, as it shows the lines along which snow began to fall simultaneously, the earliest being before noon on Christmas Day in the north-east of Ireland, the latest after 2 a.m. on Boxing Day in the extreme south-east of England. The second article is a *resumé* by Mr. Bonacina, with a bibliography, of the investigations which have been made into the influence of wind on the catch of rain in rain gauges. The remainder of part I. deals with observations on evaporation and on the duration of rainfall, specimen registers of daily rainfall, and a complete list of the changes in observing stations as compared with the previous year. The last article is devoted to the Obituary, and this is unhappily a long one, as the number of observers recently deceased is greater than in any previous year.

Part II. is devoted largely to the remarks of individual Observers on the weather of the days, months, and of the whole year in 1906, but it also contains detailed discussions of heavy falls of rain, with maps showing the distribution of rainfall on the wettest days of the year. These maps bring out the relation of the areas of heaviest precipitation to the track of the atmospheric depressions with which the rain was associated.

The discussion of the distribution of rainfall in time is continued in accordance with the plan first adopted in 1903, and the various features are illustrated by maps. Then follow the discussion of the rainfall of the months, individually and in groups, and of the year

as a whole, maps being freely used to show the difference between 1906 and an average year.

Last of all comes the General Table of total annual rainfall at the 4,267 points where rain gauges are now established, and it gives the names of all the Observers or other authorities for the record.

METEOROLOGICAL NEWS AND NOTES.

THE FIVE HUNDREDTH NUMBER of *Symons's Meteorological Magazine* is now before our readers, a fact of no little interest when the smallness of the public to which such a journal appeals is taken into account. When Mr. Symons produced No. 1 in February, 1866, he had already issued a "monthly rain circular," as a supplement to "British Rainfall" for several years, so that a greater antiquity might plausibly be claimed for the Magazine than the numeral implies. The Magazine, though small, has grown, and is not, we trust, incapable of further growth without departing from the original lines on which it was planned. As an independent organ of opinion in meteorological matters, it has, we believe, been of use in the past, and we hope that this usefulness will continue. We heartily thank the many friends who have helped us hitherto, and we look forward with confidence to a wider circle of readers.

DR. G. HELLMANN has, we are happy to learn, been appointed Professor of Meteorology in the University of Berlin and Director of the Prussian Meteorological Service, in succession to the late Professor von Bezold.

TEMPERATURE FOR AUGUST, 1907.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				N. of ALCO.
					Max.		Min.		
					°	Date.	°	Date.	
Camden Square.....	London.....	51 32	0 8	111	78·3	4	44·1	2	0
Tenterden.....	Kent.....	51 4	0 41	190	77·0	4, 29	44·0	20, 21	0
West Dean.....	Hampshire.....	51 3	1 38	137	73·0	29	37·0	25	0
Hartley Wintney.....	".....	51 18	0 53	222	74·0	5, 29	38·0	26	0
Hitchin.....	Hertfordshire.....	51 57	0 17	238	72·0	3†	41·0	27	0
Winslow (Addington).....	Buckinghamsh. r.	51 58	0 53	309	73·0	4	39·0	28	0
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	0 40	226	78·0	29	44·0	1, 2	0
Brundall.....	Norfolk.....	52 37	1 26	66	77·4	4	43·0	14	0
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	70·8	28	38·8	25	0
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	70·6	29	47·7	21	0
Polapit Tamar [Launceston].....	".....	50 40	4 22	315	70·0	29	40·2	28	0
Bath.....	Somerset.....	51 23	2 21	67	72·0	13	44·0	24	0
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	74·0	29	48·0	1‡	0
Church Stretton (Wolaston).....	Shropshire.....	52 35	2 48	800	70·0	13	32·0	20	1
Coventry Kingswood.....	Warwickshire.....	52 24	1 30	340	72·0	9	42·0	26	0
Boston.....	Lincolnshire.....	52 58	0 1	25	75·0	4	42·0	28	0
Workshop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	72·7	3	37·6	28	0
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	74·0	3, 4	37·0	27	0
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	67·7	4	42·0	30	0
Wetherby (Ribston Hall).....	Yorkshire, W.R.	53 59	1 24	130	...	...	...	...	...
Arnccliffe Vicarage.....	".....	54 8	2 6	732	...	...	...	...	...
Hull (Pearson Park).....	"..... E.R.	53 45	0 20	6	74·0	4, 5, 12	42·0	24, 28	0
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	63·6	4	38·4	30	0
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...
Haverfordwest (High Street).....	Pembroke.....	51 48	4 58	95	...	...	...	...	...
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	71·0	5‡	33·0	23	0
Llandudno.....	Carnarvon.....	53 20	3 50	72	69·8	13	45·7	30	0
Cargen [Dumfries].....	Kirkcudbright.....	55 2	3 37	80	66·0	12	34·0	30	0
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	...	...	...	...	...
Edinburgh (Royal Observatory).....	Midlothian.....	55 55	3 11	442	66·1	4	42·6	2	0
Girvan (Pinnore).....	Ayr.....	55 10	4 49	207	67·0	13	35·0	30	0
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	67·0	20	42·0	1, 25	0
Tighnabruaich.....	Argyll.....	55 55	5 14	50	62·0	12	38·0	31	0
Mull (Quinish).....	".....	56 36	6 13	35	65·0	15	...	...	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	69·2	9	38·0	30	0
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...
Aberdeen (Cranford).....	".....	57 8	2 7	120	68·0	6, 7	35·0	29, 31	0
Cawdor (Budgate).....	Nairn.....	57 31	3 57	250	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130?	...	...	...	...	...
Loch Torridon (Bendamph).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	61·0	22	42·0	31	0
Castletown.....	Caitness.....	58 35	3 23	100	64·0	5, 18	36·0	13, 28	0
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	70·0	14	46·0	1	0
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	69·0	12	40·0	30	0
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	68·0	1	40·0	29	0
Abbey Leix (Blandsfort).....	Queen's County.....	52 56	7 17	532	71·0	13	...	...	...
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	73·1	13	44·1	30	0
Ballinasloe.....	Galway.....	53 20	8 15	160	68·5	28	30·0	30	1
Clifden (Kylemore House).....	".....	53 32	9 52	105	...	...	...	...	...
Crossmolina (Enniscroe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...
Seaforde.....	Down.....	54 19	5 50	180	71·0	12, 13	40·0	29	0
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	...	...	...	...	...

† and 4, 14, 29.

‡ and 18, 29.

‡ and 23, 24.

RAINFALL FOR AUGUST, 1907.

RAINFALL OF MONTH.						RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
Aver. 870-99.	1907.	Diff. from Av. in.	% of Av.	Max. in 24 hours.	No. of Days	Aver. 1870-99.	1907.	Diff. from Aver. in.	% of Av.		
in.	in.			in. Date.		in.	in.			in.	
2.33	1.94	— .39	83	.50 14	13	15.45	13.94	— 1.51	90	25.16	Camden Square
2.37	1.93	— .44	81	.79 17	12	16.18	13.29	— 2.89	82	28.36	Tenterden
2.60	1.79	— .81	69	.88 17	15	17.83	13.99	— 3.84	78	29.93	West Dean
2.09	2.64	+ .55	126	1.10 17	13	16.06	15.59	— .47	97	27.10	Hartley Wintney
2.26	1.77	— .49	78	.49 2	15	15.07	14.59	— .48	97	24.66	Hitchin
2.53	1.78	— .75	70	.65 2	14	16.58	14.84	— 1.74	90	26.75	Addington
2.40	2.27	— .13	95	.60 2	16	15.63	16.24	+ .61	104	25.39	Westley
2.19	1.13	— 1.06	52	.36 2	14	15.01	16.00	+ .99	107	25.40	Brundall
3.18	1.72	— 1.46	54	.40 17	13	22.32	17.90	— 4.42	80	39.00	Winterbourne Stptn
2.91	.72	— 2.19	25	.17 17	13	20.69	15.90	— 4.79	77	35.00	Torquay
3.19	1.82	— 1.37	57	.44 17	19	21.57	19.09	— 2.48	89	38.85	Polapit Tamar
2.96	2.22	— .74	75	.67 2	19	18.82	19.14	+ .32	102	30.75	Bath
2.83	2.12	— .71	75	.57 17	19	18.56	17.80	— .76	96	29.85	Stroud
3.24	3.32	+ .08	102	.85 14	16	20.21	21.26	+ 1.05	105	33.04	Wolstaston
2.77	2.65	— .12	96	.67 2	15	18.08	17.75	— .33	98	29.21	Coventry
2.25	1.96	— .29	87	.55 2	13	14.45	13.16	— 1.29	91	23.30	Boston
2.31	1.72	— .59	75	.77 14	14	15.63	13.52	— 2.11	86	24.70	Hodsock Priory
2.42	3.38	+ .96	140	1.29 14	15	16.53	19.16	+ 2.63	116	26.18	Derby
4.36	5.37	+ 1.01	123	1.42 14	21	25.23	31.88	+ 6.65	126	42.43	Bolton
2.59	1.72	— .87	66	.60 14	15	16.83	16.55	— .28	98	26.96	Ribston Hall
5.43	5.37	— .06	99	.73 7	24	36.87	41.58	+ 4.71	113	60.96	Arncliffe Vic.
2.81	1.61	— 1.20	57	.79 14	12	16.55	15.32	— 1.23	93	27.02	Hull
3.14	2.32	— .82	74	.61 15	18	17.40	16.00	— 1.40	92	27.90	Newcastle
11.23	13.65	+ 2.42	122	3.38 11	26	77.96	81.11	+ 3.15	104	132.68	Seathwaite
4.52	3.89	— .63	86	1.08 2	22	25.23	23.35	— 1.88	93	42.81	Cardiff
4.04	4.39	+ .35	109	1.12 2	14	27.41	25.48	— 1.93	93	47.88	Haverfordwest
4.60	4.88	+ .28	106	1.25 15	16	26.46	30.37	+ 3.91	115	45.41	Gogerddan
2.86	3.37	+ .51	118	.67 14	17	17.65	16.21	— 1.44	92	30.98	Llandudno
4.10	4.63	+ .53	113	.90 14	20	26.15	30.63	+ 4.48	117	43.43	Cargen
3.42	...	...	...	...	...	20.56	...	...	...	33.04	Riddell House
...	3.52	...	...	.91 14	21	...	19.68	...	...	...	Edinburgh
4.34	5.88	+ 1.54	135	.64 18	31	28.46	...	...	...	48.87	Girvan
3.79	4.65	+ .86	123	.92 11	24	22.09	26.43	+ 4.34	120	35.80	Glasgow
5.13	6.48	+ 1.35	126	.86 28	25	34.11	40.26	+ 6.15	118	57.90	Tighnabruaich
4.84	7.99	+ 3.15	165	1.27 28	29	33.06	35.75	+ 2.69	108	57.53	Quinish
3.08	3.80	+ .72	123	.45 9	23	18.20	20.10	+ 1.90	110	28.95	Dundee
3.83	3.35	— .48	87	...	...	21.66	20.80	— .86	96	36.07	Braemar
3.22	2.55	— .67	79	.37 2	22	19.93	19.39	— .54	97	33.01	Aberdeen
3.07	3.27	+ .20	107	.46 10	20	18.33	21.39	+ 3.06	117	29.37	Cawdor
4.19	6.83	+ 2.64	163	.70 29	26	32.69	40.93	+ 8.24	125	56.00	Invergarry
6.91	9.59	+ 2.68	139	.71 28	31	49.41	64.96	+ 15.55	132	86.50	Bendamp
2.65	3.70	+ 1.05	140	.81 18	18	18.92	23.81	+ 4.89	126	31.60	Dunrobin Castle
...	4.38	...	...	.84 18	31	...	22.43	...	...	...	Castletown
4.92	4.40	— .52	89	.83 4	24	34.90	25.70	— 9.20	74	58.11	Killarney
3.71	3.01	— .70	81	.95 2	12	24.00	21.63	— 2.37	90	39.30	Waterford
3.79	3.50	— .29	92	.40 11	26	20.85	22.11	+ 1.26	106	33.47	Hurdlestown
3.94	3.11	— .83	79	.38 28	23	22.19	22.97	+ .78	104	35.19	Abbey Leix
3.02	2.23	— .79	74	.50 29	19	17.53	16.58	— .95	95	27.75	Dublin
3.96	3.03	— .93	77	.45 7	23	23.19	23.68	+ .49	102	37.04	Ballinasloe
7.90	...	...	...	...	...	48.34	...	...	...	80.23	Kylemore House
4.57	3.77	— .80	82	.49 3	29	29.90	32.33	+ 2.43	108	50.50	Ennisce
3.52	3.36	— .16	95	.47 2	22	23.84	26.21	+ 2.37	110	38.61	Seaforde
3.94	5.07	+ 1.13	129	.62 7	30	24.48	34.81	+ 10.33	142	41.20	Londonderry
4.03	...	...	...	...	...	23.28	...	...	...	37.85	Omagh

SUPPLEMENTARY RAINFALL, AUGUST, 1907.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches
II.	Abinger Hall	3.69	XI.	Rhayader, Tyrmynydd	4.32
"	Ramagata	1.81	"	Lake Vyrnwy	...
"	Haileham	1.62	"	Llangyhanfael, Plas Draw	2.32
"	Crowborough, Uckfield Lodge	2.75	"	Criccieth, Talarvor	3.13
"	Totland Bay, Aston House	1.32	"	Llanberis, Pen-y-pass	16.98
"	Emsworth, Redlands	1.84	"	Lligwy	4.49
"	Alton, Ashdell	3.04	"	Douglas, Woodville	4.22
"	Newbury, Welford Park	2.02	XII.	Stoneykirk, Ardwell House	4.33
III.	Harrow Weald, Hill House	1.72	"	Dalry, The Old Garroch	6.93
"	Oxford, Magdalen College	1.25	"	Langholm, Drove Road	7.57
"	Bloxham Grove	2.19	"	Moniaive, Maxwellton House	5.10
"	Pitsford, Sedgebrook	2.49	XIII.	N. Esk Reservoir [Penicuik]	4.85
"	Huntingdon, Brampton	2.07	XIV.	Maybole, Knockdon Farm	2.72
"	Wisebech, Bank House	2.07	XV.	Campbeltown, Witchburn	5.55
IV.	Southend Water Works	1.64	"	Inveraray, Newtown	9.97
"	Colchester, Lexden	2.00	"	Ballachulish House	9.84
"	Newport, The Vicarage	2.19	"	Islay, Eallabus	6.59
"	Rendlesham	1.48	XVI.	Dollar Academy	5.57
"	Swaffham	1.98	"	Loch Leven Sluice	4.16
"	Blakeney	1.91	"	Balquhiddier, Stronvar	8.25
V.	Bishops Cannings	3.09	"	Perth, Pitcullen House	3.56
"	Ashburton, Druid House	1.42	"	Coupar Angus Station	3.78
"	Okehampton, Oaklands	2.97	"	Blair Atholl	4.06
"	Hartland Abbey	2.70	"	Montrose, Sunnyside Asylum	2.41
"	Lynmouth, Rock House	2.86	XVII.	Alford, Lynturk Manse	2.71
"	Probus, Lamellyn	1.32	"	Keith Station	3.20
"	Wellington, The Avenue	...	XVIII.	N. Uist, Lochmaddy	5.10
"	North Cadbury Rectory	2.28	"	Alvey Manse	3.06
VI.	Clifton, Pembroke Road	2.29	"	Loch Ness, Drumnadrochit	2.81
"	Ross, The Graig	2.66	"	Glencarron Lodge	9.10
"	Shifnal, Hatton Grange	2.88	"	Fearn, Lower Pitkerrie	1.39
"	Cheadle, The Heath House	3.62	XIX.	Invershin	3.09
"	Blockley, Upton Wold	2.41	"	Altnaharra	3.04
"	Worcester, Boughton Park	2.26	"	Bettyhill	4.93
VII.	Market Overton	2.44	XX.	Dunmanway, The Rectory	6.08
"	Market Rasen	2.41	"	Cork	...
"	Bawtry, Hesley Hall	1.96	"	Darrynane Abbey	5.72
VIII.	Neaton, Hinderton Lodge	2.95	"	Glenam [Clonmel]	2.54
"	Southport, Hesket Park	3.70	"	Ballingarry, Gurteen	3.40
"	Chatburn, Middlewood	4.93	"	Miltoon Malbay	5.64
"	Cartmel, Flookburgh	4.81	XXI.	Gorey, Courtown House	2.42
IX.	Langsett Moor, Up. Midhope	3.23	"	Moynalty, Westland	3.12
"	Scarborough, Scalby	1.57	"	Athlone, Twyford	3.33
"	Ingleby Greenhow	2.39	"	Mullingar, Belvedere	3.15
"	Mickleton	2.32	XXII.	Woodlawn	4.62
X.	Hardon Mill, Beltingham	...	"	Westport, Murriak Abbey	...
"	Kwesley, Fallowles	2.99	"	Collooney, Markree Obey	4.02
"	Ilderton, Lilburn Cottage	2.10	"	Mohill	3.51
"	Keawick, York Bank	4.93	XXIII.	Enniskillen, Portora	...
XI.	Llanfrehfa Grange	3.89	"	Warrenpoint, Summer Hill	2.85
"	Treherbert, Tyn-y-waun	9.23	"	Banbridge, Milltown	2.69
"	Carmarthen, The Friary	4.71	"	Belfast, Springfield	3.95
"	Castle Malgwyn [Llechryd]	3.26	"	Bushmills, Dundarave	5.28
"	Plynlimon	14.35	"	Stewartstown, The Square	3.14
"	Crickhowell, Fordlas	3.40	"	Killybegs	7.48
"	New Radnor, Ednol	3.90	"	Horn Head	5.27

METEOROLOGICAL NOTES ON AUGUST, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

CAMDEN SQUARE.—Another month of low temp., the mean being $60^{\circ}\cdot 8$, or $1^{\circ}\cdot 3$ below the average: the max. temp. was low throughout. Unsettled weather prevailed during the third week with T at times, and a violent squall occurred on 20th, accompanied by T, L, R and H. Duration of sunshine $149^{\circ}\cdot 7^{\circ}$ hours, and of R $27^{\circ}\cdot 3$ hours.

CROWBOROUGH.—Low temp. and frequent R up to 22nd, after which warmer and more settled. R 24 in. below the average of 36 years. Mean temp. $58^{\circ}\cdot 1$, or $2^{\circ}\cdot 1$ below the average.

BURY ST. EDMUNDS.—Cold and dull, with little sunshine except in the last week. Corn ripened very slowly, and much was not yet fit to cut at the end of the month.

TORQUAY.—Duration of sunshine $189^{\circ}\cdot 6^{\circ}$ hours, or $17^{\circ}\cdot 9$ hours below the average. Mean temp. $60^{\circ}\cdot 6$, or $1^{\circ}\cdot 0$ below the average.

NORTH CADBURY.—A cool, cloudy and showery August, windy from 6th to 23rd, but quiet and warm at the end.

WOLSTASTON.—Cold and wet with insufficient sunshine. On 20th a frost occurred in the air, which is unprecedented in August.

BOLTON.—The temp., particularly that of the earth, was again very low. Mean temp. $55^{\circ}\cdot 1$, or $2^{\circ}\cdot 7$ below the average. Duration of sunshine $104^{\circ}\cdot 6^{\circ}$ hours, or $13^{\circ}\cdot 7$ hours below the average. Crops were late and harvest conditions bad.

SOUTHPORT.—Cool, but chiefly remarkable for abnormal prevalence of strong S.W. and W. winds. Mean temp. $57^{\circ}\cdot 5$, or $1^{\circ}\cdot 8$ below the average. Duration of sunshine 163° hours, or 17 hours below the average. Duration of R $68^{\circ}\cdot 3$ hours. Water levels were very high.

CARMARTHEN.—Wet and cold. The hay harvest was much retarded by constant R, and corn was a good deal beaten down, but forage was plentiful.

HAVERFORDWEST.—Generally cold and unsettled, with considerable R. Corn crops were much damaged by R and strong winds. Duration of sunshine $151^{\circ}\cdot 2^{\circ}$ hours.

DOUGLAS.—A most unseasonable month, nearly if not quite as bad as June. It was cold, wet, gloomy and extremely windy, with hardly one calm or summer-like day to redeem its evil character.

CARNEG.—Wet and sunless, with strong W. winds whenever it did not rain. Hay was much damaged, and corn wherever heavy was considerably "lodged"; the harvest was not commenced at a date three weeks later than in 1906.

STRONVAE.—Extremely wet and cold, with very little sunshine and high N.W. winds.

COUPAR ANGUS.—The coldest August since 1888. Mean temp. $53^{\circ}\cdot 6$, or $2^{\circ}\cdot 0$ below the average. It was the fourth successive month with low temp., and the fifth with R above the average.

DRUMNADROCHIT.—R 12 below, and rain days 4 above, the average of 21 years.

DUNMANWAY.—Very fine from 19th to 27th, and warm from 23rd to 27th. Great TS on 11th, with vivid L, lasting two hours, and $\cdot 76$ in. of R between 7.30 and 10.30 p.m.

DARRYNANE ABBEY.—Raw and ungenial, with few fine days. R 25 per cent. above the average.

MILTOWN MALRAY.—Continuously wet, with only two bright days. The temp. was low, and hay, corn and turf was rotting.

DUBLIN.—Changeable, cool, breezy and showery, with constant fresh westerly winds. Mean temp. $58^{\circ}\cdot 8$, or $0^{\circ}\cdot 9$ below the average.

BANBRIDGE.—R $\cdot 72$ in. below the average of 45 years.

Climatological Table for the British Empire, March, 1907.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point	Humidity.	Max. in Sun.	Max. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
London, Camden Square	68·7	31	24·4	12	54·4	35·2	37·8	81	101·1	23·1	inches .97	13	...
Malta	...	...	...	...	...	...	...	...	...	...	...	...	...
Lagos	91·5	19	73·0	2	89·4	78·8	75·1	71	158·0	70·0	2·65	4	7·4
Cape Town	91·0	9	55·0	16	76·5	60·3	57·0	69	...	...	·83	5	3·5
Durban, Natal	89·1	8	62·1	26	83·7	68·2	...	...	147·1	...	1·96	14	4·4
Johannesburg	79·0	6	49·0	26	74·0	54·8	55·6	79	181·0	48·8	2·86	8	3·6
Mauritius	87·2	15	69·0	11	83·9	71·4	70·4	79	155·3	62·7	7·31	20	6·6
Calcutta	93·7	9	58·0	1	87·8	67·5	64·6	68	153·0	51·2	4·02	5	3·8
Bombay	90·4	31	70·7	14	86·6	73·9	69·3	71	132·9	62·9	·00	0	0·8
Madras	95·1	23	66·2	4	89·7	73·4	71·5	76	144·5	62·1	·00	0	2·3
Kodaikanal	72·0	15	46·0	2	68·4	51·0	44·6	64	144·2	35·2	1·79	12	3·1
Colombo, Ceylon	92·4	11	71·1	1	89·1	74·8	72·1	73	152·0	68·2	1·06	13	3·6
Hongkong	80·1	25	48·5	2	63·4	59·7	58·7	80	131·2	...	·34	7	8·0
Melbourne	88·9	11	43·0	27	71·2	52·9	48·7	64	146·5	31·9	1·63	9	5·6
Adelaide	89·8	11	46·5	22	75·3	55·2	49·5	58	146·0	38·3	·81	6	4·2
Coolgardie	95·9	9	50·0	13	79·8	58·6	55·8	62	165·2	46·6	5·27	9	4·4
Sydney	90·0	5	51·4	27	74·3	61·1	58·5	76	127·3	46·0	8·43	21	6·8
Wellington	77·5	12	47·6	21	67·2	57·5	54·6	74	126·0	39·0	5·49	11	6·0
Auckland	77·0	5	54·0	20	72·0	61·7	59·1	79	140·0	49·0	·97	7	5·7
Jamaica, Negril Point.	88·8	16	62·3	10	85·6	66·2	64·3	65	...	...	·08	1	...
Trinidad	90·0	16	66·0	sevr.	85·4	60·4	70·6	78	159·0	64·0	1·71	9	...
Grenada	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	...	...	...	...	...	...	...	...	...	...	...	...	...
Fredericton	50·3	30	-17·2	1	33·0	11·6	...	67	...	...	·41	2	5·0
St. John's, N.B.	52·3	29	-3·2	5	36·0	19·6	...	...	...	...	·75	6	5·3
Victoria, B.C.	57·0	20	28·7	30	49·6	35·2	...	...	...	...	1·40	14	5·7
Dawson	33·0	9	-41·5	21	9·8	-15·4	...	...	...	...	·00	0	3·8

Johannesburg.—Bright sunshine 255·8 hours, or 70 per cent. of the possible amount.
Mauritius.—Mean temp. of air 0°·1, dew point 0°·2, relative humidity 1·0 per cent.,
 and E 1·28 in. below, averages. Mean hourly velocity of wind 6·8 miles, or 3·6
 miles below average.

MADRAS.—Bright sunshine 261·1 hours.

KODAIKANAL.—Bright sunshine 245 hours.

COLOMBO.—Mean temp. of air 81·9 or 0°·2 below, of dew point 0°·8 below, and E
 3·54 in. below, averages. Mean hourly velocity of wind 6·9 miles. TSS on 3 days.

HONGKONG.—Mean temp. of air 63°·8. Bright sunshine 86·8 hours. E 2·30 in. below
 average. Mean hourly velocity of wind 12·8 miles.

Adelaide.—Mean temp. of air 4°·9 below, and E ·26 in. below, averages. The
 coldest March in the 50 years' records.

Sydney.—Mean temp. of air 1°·5 below, and E 3·20 in. above, averages.

Wellington.—Mean temp. of air 1°·8 above, and E 2°·09 in. above, averages.

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THE DROUGHT OF SEPTEMBER, 1907.

THE long-deferred spell of genuine summer weather which came in September, following a dismal succession of cold and gloomy months, has elicited a chorus of praise in the daily press, and we conclude that the absence of rain was viewed with no little satisfaction both by the agriculturalist and the pleasure-seeker. Crops in many places, after causing no little anxiety, ripened with great rapidity, and in Scotland we believe that what promised to be a late harvest was converted into an unusually early one.

Under the influence of settled anti-cyclonic conditions, the prevailing weather in different parts of the British Isles was of a remarkably uniform type, and, broadly speaking, it was only in Scotland and the south of Ireland that any rain of consequence fell after the 6th day of the month. The absolute drought resulting was therefore unusually prolonged, especially taking into account the wide area over which it was spread. On the average of about twenty years, the longest drought of the year at any one station in the British Isles is 25 days, whereas in the present instance not one station only but large tracts of the country were entirely without rain for this period. The accompanying map shows by the unshaded area on the land those parts where a technical "absolute drought" occurred, i.e., a period of more than 14 consecutive days with no rain recorded. In parts of the north-west of England a period of 25 or 26 days was cut in half by an entry of '01 in of "rain" occurring midway, and this was sometimes the result of fog-condensation, itself an indication of the continuance of unbroken anticyclonic influence. The map thus shows less rather than more of the drought which took place. However, it brings out well the absence of absolute drought over the greater part of Scotland and Ireland, which are shaded, and throws into contrast the large area, including practically the whole of Wales, the west Midlands and the Wessex region within the dotted line, over which from 20 to 25 consecutive days passed without measurable rain. It is rather striking that the drought was best established over the normally wettest districts of the Welsh uplands. In the eastern half of England a little rain on or about the 25th curtailed the period to about 18 days, after which it was dry again.

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The amount of rain during the whole of September was unusually small over the whole country, and it is a rare occurrence in any month for so considerable a proportion of the British Isles to receive less than an inch. The most noticeable feature was the extraordinary uniformity of the fall over England and Wales, where it scarcely differed from .60 in. to .70 in. at any stations except in the hills of Cumberland and Wales and in the Cornish peninsula. A narrow strip on the east coast of England, including Northumberland, had less than half an inch.



ON SOME OF THE CAUSES AND EFFECTS OF ATMOSPHERIC ELECTRICITY.

By L. C. W. BONACINA.

WHEN in the eighteenth century Franklin, together with Dalibard and Richmann, experimentally demonstrated beyond doubt that lightning was an electric discharge, he laid the foundations of the science of atmospheric electricity, the phenomena of which, though they have in more recent times formed the subject matter of a large number of theories, are still very imperfectly understood with regard to their causes and effects. Franklin's views upon electrical science in general may appear somewhat crude to those who are acquainted with the abstruse conceptions of modern physics upon such matters, just as does, for instance, the theory of light of the great Newton, the archetype of the natural philosopher; but, as regards this subject of atmospheric electricity, it may be said that the knowledge of solid facts such as that established by Franklin is sorely needed if the application to the problems of the atmosphere of advanced physical theory is to be productive of fruitful results.

To account for the origin of the electricity of our atmosphere, various natural operations conducted on an extensive scale upon the Earth's surface—such as the physical processes involved in evaporation, or the chemical processes in vegetation, animation and organic decomposition—have been invoked; but hitherto it has been generally considered that the only known agent adequate to explain the observed electrification of the air is friction—the friction of bodies against one another through the instrumentality of wind.

The discovery of "ionization" of the atmospheric gases, however, akin to that of salts in solution, has indicated further very probable sources of electricity. In order to gain a clearer understanding of the nature of ionization, let us refer to the phenomena of the Crookes' vacuum tube, together with those connected with the property of radio-activity which is possessed in so marked a degree by the recently discovered element radium. In the first place, what is radio-activity? and what grounds are there for believing it to constitute a factor in electrifying the air? It would be impossible to answer these questions adequately within the limits of a meteorological article, but it may be well to explain the essential idea of the theory of radio-activity in the interests of the present subject. Firstly, it is necessary to distinguish between two kinds of radiation which may be emitted from bodies—namely, the ordinary radiation and radio-activity.

By the ordinary radiation we mean the energy which is transmitted through, or rather by means of, the ether by a body in virtue of the energy possessed by the body in the form of heat or molecular motion. Any body, then, whatever its temperature may be, short of absolute zero, is always emitting and absorbing radiant energy, whether it rises or falls in temperature depending upon the balance

between loss and gain. This species of radiant energy consists, as is well known, of vibrations in the ether, the wave-lengths increasing from the ultra-violet actinic rays to the infra-red or dark "heat" rays, or, further still, to the very long "electric" waves of Hertz. How much of the spectrum is represented in the radiation from any particular body at any time depends upon its chemical and physical constitution as well as upon its temperature, and is a purely physical question. The important thing to note is that the heat energy of the body—the vibratory or kinetic energy of its molecules—is transmitted across the ether in what Maxwell believed to be electromagnetic waves, and that the communication of energy from molecules to ether is effected in a special manner which it would here be irrelevant to discuss in accordance with the present electronic view of matter.¹

We shall now be able to obtain a clearer conception of what is meant by radio-activity, or the "extraordinary" form of the radiation of energy. A body like radium which exhibits the phenomenon of radio-activity is conceived to be in a state of atomic rupture or disintegration, its atoms undergoing decomposition into lighter ones. This phenomenon is conspicuous in certain chemical elements which have very heavy atoms, or, in the language of chemistry, are of high atomic weight, and the atomic explosion, as we might call it, which is made manifest by it naturally gives rise to molecular or thermal disturbances within a radio-active body, thus producing the ordinary kind of radiation as well.

From the cathode of a Crookes' vacuum tube connected with an induction coil something of a very interesting nature is shot off. These cathode rays were designated by Crookes about thirty years ago as matter in a "fourth state," and for a long time their nature remained most puzzling to physicists. Without entering into details as to the various properties of the cathode rays, it may be said at once that they consist of inconceivably minute particles torn away from the cathode, and each of these particles is called an "electron."

Professor J. J. Thomson, of the Cavendish Laboratory, Cambridge, upon the basis of an extensive and brilliant series of experiments a few years ago, calculated the mass of an electron to be about $\frac{1}{700}$ th of that of the lightest known atom of matter, namely, hydrogen, and its velocity in the vacuum tube about $\frac{1}{10}$ th that of light, or 18,000 to 19,000 miles a second. Now, particles essentially identical with electrons are emitted from radium and other radio-active bodies. In accordance with the electric theory of matter, which rests upon a high degree of probability, but cannot yet be conclusively proved, we may regard the electron as an atom of negative electricity or as the unit electric charge; and an atom of matter as a structure, the dynamics of which is at present the subject of much discussion, composed of a number of these negative charges or electrons in

¹ See, for instance, Sir Oliver Lodge, *Phil. Trans.*, 1893, Vol. 184, p. 750.

association with positive charges. Thus is matter expressed in terms of electricity.

This is truly a magnificent doctrine ;² but I have here endeavoured to outline it in the fewest words possible. The bearing of these theoretical questions upon the subject in hand will now be apparent. For the sun is an intensely radio-active body, and the radiator not only of the electro-magnetic waves which constitute light and dark "heat" rays, convertible more or less into heat upon striking matter, but also of electrons which probably after electrifying the upper air cause an accumulation of negative electricity on the Earth's surface, and, constituting electric currents of moderate strength, originate magnetic storms and auroral displays. When they enter the Earth's atmosphere these electrons partially "ionize" the molecules of the atmospheric gases, that is to say, decompose them into their constituent atoms, which, being oppositely charged, form positive and negative "ions" (anions and kations), much in the same way as the molecules of, say, chloride of sodium, or sulphate of copper when dissolved in water, undergo partial decomposition (by the mere process of solution) into the charged bodies or ions,



respectively which can be separated by passing an electric current through the solution. Another potent source³ of electrons causing ionization of the upper air is believed to be the action of ultra-violet light upon the ice or snow particles of high-level cirrus clouds, and the causes of ionization in the atmosphere are thought to be numerous.

There are then at least two general sources of atmospheric electricity, (1) mechanical friction ; (2) ionization.

It is now expedient to inquire into the effects of the electrification of the atmosphere or the meteorological phenomena due to its existence. The subject may be conveniently divided into : (a) the influence of electricity upon the condensation of aqueous vapour, (b) the manifestation of electricity in thunderstorms and in auroral displays, magnetic storms and kindred phenomena, (c) thermo-dynamic effects. Owing to the limitation of space I shall, in this article, only be able to dwell upon the first division.

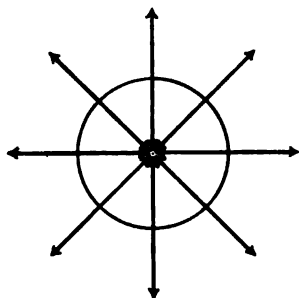
It has hitherto been supposed that in air deprived of dust aqueous vapour will not condense when the temperature of saturation is reached. Aitken showed that for condensation to take place nuclei must be present to serve as points of attachment to drops of water.

² For a clear exposition of this theory, Sir Oliver Lodge's excellent book on "Electrons" may be consulted. (London : George Bell & Sons, 1906.)

³ It has recently been argued on mathematical grounds that electrons must be limited in their approach to a magnetized body like the Earth to the region near the magnetic poles. (See *Nature* for September 5th, 1907, p. 481.) However this may be it is not supposed, as indicated above in the text, that the atmosphere in general depends for ionization upon the discharge of solar electrons alone.

The required nuclei have been supposed to be supplied by the impalpable dust consisting of diverse materials generally present in the air even at high levels. No one doubts but that dust plays an important part; but, inasmuch as the quantity of dust decreases very rapidly upwards, one cannot positively assert without direct evidence that it is always sufficient to minister to the wants of every mass of saturated vapour. It is known, however, to physicists that "ions" can also serve as condensation nuclei, and it is consequently inferred that the ions of the atmosphere give rise to the condensation of moisture. This brings us at once to the consideration of the theory of condensation nuclei in general, whether they be dust particles or ions. In the first place Lord Kelvin has shown that an infinitesimal globule of liquid cannot exist, it must immediately vapourize. If, however, such a globule can attach itself to a surface of finite curvature, such as that afforded by a dust particle, then it will pass into a stable liquid condition if its temperature is below the vapour-saturation point.

Ions, it will be remembered, are *atoms bearing a charge of electricity*; those present in the atmosphere will, therefore, generally be charged atoms of oxygen or nitrogen. Although a minute globule of water possessing an infinitely convex surface cannot exist in the ordinary condition it can do so if in the electrified condition. The reason of this is explained mathematically by physicists.⁴ A drop of water by reason of the curvature of its surface experiences a radial-component of surface tension directed inwards, and therefore an increased



internal pressure; whereas, in virtue of its surface electrification, it is subjected to an electric tension directed outwards. These two antagonistic forces operating upon the globule of water, I represent in the annexed diagram. The circle represents a plane section of the spherical water droplet; the interior arrows show the direction of the radial-pressure component of the surface tension, and the exterior that of the electric tension due to the uniform

surface charge. There is a certain critical size at which the ionic charge (*vide ut supra*) will balance, so far as condensation is concerned, the surface tension, so that the convex electrified droplet will act as though it were unelectrified and flat, that is to say, it will be able to have a stable liquid existence. The critical size is of the order 10^{-24} c.c. ($\frac{1}{1,000,000,000,000,000,000,000,000}$ cubic centimeter); in other words, it is of atomic dimensions. Hence, it is inferred that an ion

⁴ J. J. Thomson, "Applications of Dynamics to Physics and Chemistry." Lodge, "Electrons," p. 81.

(atom + electron) can play the part of a condensation nucleus. It thus appears that electricity may act as the initial impulse required to condense vapour when it is saturated. But it is further extremely probable that the small electrified drops so formed in the first stage of condensation are caused to coalesce in virtue of the charges upon them, and thus to continue the process. It was, indeed, experimentally determined by Lord Rayleigh⁵ in 1879 that drops of water which are slightly and similarly electrified (the similar electric charges upon the drops not being strong enough to effect electrostatic repulsion) have a pronounced tendency to coalesce. I would here provisionally suggest that we have here at least a partial explanation of the characteristic difference between the cyclonic rain of winter and the thunder rain of summer. There is, of course, no line of demarcation between the two types of precipitation, but the extreme form of each is very distinct. The large drops and usually great concentration of the thunder rain are likely to result from the coalescence of cloud droplets produced in the first stage of condensation; droplets possessing a charge sufficient to effect such coalescence, but not sufficient supposing all the charges to be of like sign to engender mutual repulsion. In the case of the cyclonic rain, on the other hand, one may suppose the aggregation of small drops to form rain drops to be brought about mainly by mechanical or other means, the individual electric charges on the smaller drops being so insignificant that they cannot promote their growth, or at all events not to the same extent as in the thunder rain. It appears, therefore, that although the electric manifestations of thunderstorms certainly proceed from the condensation of vaporous masses involving the greatly increased concentration of electricity necessary for the occurrence of disruptive discharges, the condensation itself may partly result in two distinct ways from the operation of electricity in the atmosphere; so that whether it is correct to call condensation a cause or an effect of electrification depends very much on the terms of our electricity. I will not in this essay touch upon the electrostatic induction theory of thunderstorms as that is well known, so far indeed as it is applicable to the scanty and inadequate observations which we are able to make upon them.

⁵ *Proceedings of Royal Society*, 1879, Vol. 13, p. 406. "The Influence of Electricity on colliding Water Drops." From this article I quote the two following passages (the experiments were made with water-jets):—

"Instead of rebounding after collision as the unelectrified drops of clear water generally or always do, the electrified drops coalesce, and thus the jet is no longer scattered about. When the electrical influence is more powerful the repulsion between the drops is sufficient to prevent actual contact, and then, of course, there is no opportunity for amalgamation."

" Now from what has appeared above we have every reason to suppose that the results of an encounter will be different according as the electrified condition of the particles, and we may thus anticipate an explanation of the remarkable but hitherto mysterious connection between rain and electrical manifestations."

The phenomenon of the aurora associated with those of sun-spots, magnetic storms, etc., has long been shrouded in mystery. The theory latterly proposed by Arrhenius, though in nowise proved, has at least the merit of being simple, definite and also very beautiful. The Earth's magnetic lines of force are thought to guide the electrons received from the sun in spiral courses away from the tropical regions towards the magnetic poles, where in the rarefied upper air there occur on a magnificent scale the phenomena of the vacuum tube. Hence the surpassing glory of the long winter nights.

The other remaining important effects of atmospheric electricity are difficult and complicated subjects, and their discussion must be left over for a future paper.

These effects⁶ are concerned with the influence of ionization upon temperature in the several strata of the atmosphere and hence upon the diurnal variations of the barometric pressure, the gradient of electric potential and other periodic changes.

AERIAL NAVIGATION.

THE autumn of 1907 will be remembered as the time when the possibilities of navigating the air were finally proved beyond question. In France, in Germany, and in England, notable flights have been made by the military air-ships, in the perfecting of which all the great powers have been keenly interested for some years. The longest flight, and the greatest time in the air, appears so far as we can judge from the newspaper reports, to have been attained by Count Zeppelin's great air ship on the Lake of Constance; but none of the recorded efforts seem to have been more satisfactory than those of the British military air-ship at Aldershot. Colonel Capper and Mr. S. F. Cody had already made several preliminary flights at Aldershot, proving that the great sausage-shaped gas-bag which gave bouyancy to the platform carrying the motor and propellor could be controlled in its movements, both horizontally and vertically with perfect ease; but on Saturday, October 5th, they steered the *Nulli Secundus* from Aldershot to London, circled round St. Paul's, performed various evolutions over the Horse Guards, and, the wind having become too strong to permit of a return to Aldershot, they steered the aerial craft to the Crystal Palace, and descended gently in the midst of the enclosed cycle track. The success of aerial navigation must of necessity stimulate the study of meteorology, and it promises to open a new and fascinating area for meteorological research.

⁶ "Studies on the Diurnal Periods in the Lower Strata of the Atmosphere." By F. H. Bigelow, U.S. Department of Agriculture, Washington, 1906.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE DROUGHT OF SEPTEMBER, 1907, AT CLIFTON.

THE absolute drought of 25 days in this month, from the 6th to the 30th, was the longest experienced in 52 years, with the exception of one of 26 days, from February to March 1st, in 1897. This month was also the driest September in the above period, with the exception of September, 1865, when only .05 of an inch of rain was measured.

It is noteworthy that we have now had four dry Septembers in succession, viz.:—1904, 1.54 in.; 1905, 1.33 in.; 1906, .82 in. and 1907, .62 in. The average for 34 years is 3.03 in.

ROBT. F. STURGE, F.R.Met.Soc.

101, Pembroke Road, Clifton, 5th October, 1907.

SEPTEMBER'S SUMMER.

SEPTEMBER fully upheld its title to be considered a real summer month in 1907, for it provided beautiful harvesting weather of sunshine and drought between the 6th and end of the month. It is true the temperature was not nearly so high as it was in 1895 and 1865, but the fine, dry period came at the end of a very disappointing season this year, and brought some recompence for the ungenial atmosphere prevailing in June, July and August. Looking back to old records it is perhaps a little curious that we had very hot Septembers in 1795, 1805, 1815, 1825, 1865, 1875, 1895, and that the month was very cold in 1820, 1830, 1840, 1850, 1860 and 1870; but 1810, 1880 and 1890 were extremely warm, while 1845 and 1885 proved cold, so that the sequency in decades is by no means regular. Yet it is sometimes interesting to point out any approach to cyclical variations in weather characteristics, for though they are usually the result of obvious coincidences, they nevertheless have a very suggestive and significant look about them.

Our recent experience will prompt us to assent to Orlando Whistlecraft's description of September, when he says, "This month when fine is one of the most delightful in the year for walking, riding, or driving, as the calm serenity, with the peculiarly beautiful clouds, and agreeable softness of temperature, yield the most pleasing sensations."—*Climate of England*, p. 11.

W. F. DENNING.

Bishopston, Bristol, September 30th, 1907.

THE SUNSHINE RECORDER.

ALLOW me to express my appreciation of the article "Distribution of Bright Sunshine over the British Isles," given in the September number of your Magazine.

Mr. Curtis has given us some very useful and important information, and the table of hours duration in different latitudes will prove

of very practical use. We learn that the Campbell-Stokes recorder is accepted as the officially recognized instrument. But yet I believe that observers often find difficulty in giving a *faithful* result of the daily records; the discoloration is frequently so faint, or terminates in so sharp a point that the time of beginning and ending is almost impossible of correct estimation.

Now, very recently, I have observed when the sun has declined, say below 15 degrees of the horizon, with no clouds, that for nearly an hour there has been a clear bright spot running on the card, but no apparent mark left for determining the exact time. I do not know whether photography would reveal an impression. Can the card be made more sensitive—is it possible to bring in the aid of chemistry to perfect a contrivance which seems, in all other respects, to be the best sunshine recorder yet devised?

Deal, 30th September, 1907.

TURNOR PEEL.

WANTED! A NAME.

COULD not a more convenient and appropriate name be found for the branch of science dealt with in your pages? "Meteorology" is awkward enough; "Meteorological" is worse, and might serve as a test for sobriety; and what Englishman will tackle that jaw-breaker, the *Meteorologische Zeitschrift*?

Meteorology is the science of meteors; but we have restricted the sense of that word. Again, it is the science of "things lifted up," of things above the earth; a primitive conception which might seem to include birds, &c. Formerly it included the heavenly bodies, and to-day it takes cognizance of the sun, prime cause of weather; also, at times, of the moon. These are both "up" and "down," or neither. Once more, we record underground temperature.

Why not "aerology"? though this has been lately proposed for a special line of inquiry? It might be interesting to have suggestions on the subject.

A. B. M.

Gadebridge, Crouch End, September 10th, 1907.

THE SPECTRE OF THE BROCKEN.

LAST Friday, 20th September, I saw this phenomena very clearly from the cliffs here. There was a dense fog seaward and brilliant sunshine on the hill. A friend and I were walking near the East Cliff when we remarked the shadows of our figures thrown on the fog—the cliff is from 150 to 200 ft. high, and the lower part of the fog was in deep shadow—our figures appeared, as it were, walking on the top of the shadow. A halo, or corona appeared over our heads. Further on along the cliffs, whenever our shadows were thrown on the fog, the same phenomenon was repeated.

H. A. COSGRAVE.

Howth, Co. Dublin, September 24th, 1907.

A RARE CLOUD-FORM.

FOR the first time I witnessed the so-called Pocky or Pocket Cloud at Hampton Court, on August 15th, 1907, between 3.30 and 4 p.m. It consisted of about a score of seemingly huge black balls, well formed, touching each other, the upper part evidently extended cloud, as no blue sky could be seen in the interspaces. They sagged somewhat before passing into dense cumulus very slowly, no rain falling. These balls occupied a large space about the zenith, though not central there. They may have been apparent long before I noticed them; seemed stationary, and lost the globular formation with a scarcely perceptible motion, the air being nearly calm.

Believing this cloud to be very rare is my excuse for sending this note. Being my first interview, attention was fixed upon the Pocket, and I now find I should have estimated angles, etc.

R. STRACHAN.

61, Oxford Road, N., 10th October, 1907.

THE STUDY OF WEATHER PHENOMENA.*

By Rev. D. C. BATES, F.R.G.S., F.R.Met.Soc.

NATURE-STUDY has only of recent years been recognised as a branch of education, or as a proper means of training the mind, and of equipping it with useful knowledge for the battle of life. Formerly, primary school teachers were almost entirely limited to drilling their scholars in the three "R's,"—reading, writing and arithmetic. Work was little less monotonous in the secondary schools, because the universities which set the standard for them so fostered the study of the classics and higher mathematics that those who sought degrees had ruthlessly to confine their studies to dead languages, or intricacies of calculation, so that even modern literature and languages (to say nothing of science) were neglected. Under those conditions real education had almost to commence when the doors of the school or college closed behind the students. But now even the oldest and most conservative universities have undertaken to teach and grant degrees in literature, science and art. In this way many of the best European and American universities now have regular or special courses in meteorology.

The weather is studied especially in the secondary schools of the United States of America, and a large proportion of the primary schools of that progressive country adopts it as an important branch of work.

The study of weather phenomena may be used as a means for training children in intelligent observation and accuracy, attention and patience; the memory is cultivated by practical illustrations

* A paper read to a gathering of teachers at the Training College, Wellington, N.Z., August 1st, 1907.

and associations, not only of the weather phenomena with each other, but with their actual results, and in this respect the reasoning faculties are exercised in the study of cause and effect. Lastly, such knowledge is often obtained that the person so trained develops capabilities for the forecast of local weather. It must not, however, be expected that all who study weather will become "weather-wise," or learned in coming changes, yet if once the art of forecast be acquired in any degree, it cannot possibly be neglected or grow rusty for want of use in any temperate region of the Earth, such as this in which it is our happy lot to find ourselves, though even here some who really ought to know better do little else but grumble at the weather.

Thus it is that phenomena which are hardly observed cannot be remembered, associated with other examples and used as an experience in life. "One eye in all Verona saw the beauty of that sky," could often be repeated of many a crowded city, where men hardly know which way the wind blows.

At sea and in the country it is different, for there the weather is the dominant topic of conversation, and all business and pleasure directly depend upon it. Consciously or unconsciously everybody there studies it more or less, but to get the best results even in the study of weather the mind needs direction and training. Country teachers have in their scholars wonderful opportunities for good work, which are not always recognized and appreciated at their full due. An American writer indicates these when speaking of larger issues he wrote:—"The country boy is often more successful than the city bred boy, partly because he has developed habits of personal observation and experience; because he has had natural and not artificial things around him. He sees nature in a large way and is quick to grasp conditions and foresee results."

Meteorology can undoubtedly assist you in your work as a teacher. In its elementary form it has manifold and fundamental relationships to other branches of learning, such as geology, chemistry, astronomy, biology, and above all geography. We go from the known to the unknown, step by step, line upon line we acquire knowledge, and before we can really be thought to hold it, we must attach our impressions one by one to some fact already in the storehouse of our own knowledge and experience. Meteorology may furnish a valuable link in many a chain of association because a knowledge of climatic conditions often illustrates and explains the phenomena of natural science and human history. Thus practical acquaintance with the seasons in their varying phases of temperature, wind, rainfall, &c., when definite and accurate, may be used not only as a basis of comparison in estimating climates, but also as the standard by which we gauge results in the products of the Earth and of human activities.

It is not necessary to purchase either an extensive literature or an expensive equipment of instruments, before we commence the study

of weather phenomena. Much that is well worth doing and may be well done is accomplished with only simple methods of study in the book of Nature itself. Those who postpone their studies in meteorology until they can get a supply of expensive instruments, are in thus placing their uncertain hopes in the dim and distant future, really neglecting the root of the matter, and in great danger of having no foundations for the scientific study of weather, should they ever become the possessors of a meteorological observatory. They may become very useful to meteorological science, but not having the root of the matter in them, they frequently only become drudges at statistics. An observant and thoughtful child who may know nothing about barometers, thermometers, anemometers, &c., but who watches the skies, will after all be a better guide to the weather than they, for instrumental knowledge is but a poor substitute for meteorological science. Writing about the study of the clouds John Ruskin once said:—"There is no study open to you in all the expanse of science where so much can be done by dexterous attention and patience, *without the aid of costly instruments*, and in the lovely and healthy laboratory of the air." At another time the same writer described meteorology in the following terms:—"It is a science of the pure air, and the bright heaven; its thoughts are amidst the loveliness of creation; it leads the mind, as well as the eye, to the morning mist, and the noonday glory, and the twilight cloud, to the purple peace of the mountain heaven, to the cloudy repose of the green valley; now expatiating in the silence of stormless ether, now on the rushing wings of the wind. It is indeed a knowledge which must be felt to be, in its very essence, full of the soul of the beautiful. For its interest it is universal; unabated in every place and in all time. He whose kingdom is the heaven can never meet with an uninteresting space, can never exhaust the phenomena of an hour; he is in a realm of perpetual change, of eternal motion, of infinite mystery. Light and darkness, cold and heat, are to him as friends of familiar countenance, but of infinite variety of conversation, and while the geologist yearns for the mountain, the botanist for the field, and the mathematician for the study, the meteorologist, like a spirit of higher order than any, rejoices in the kingdoms of the air."

(To be continued.)

REVIEWS.

Second Annual Report of the Meteorological Committee to the Lords Commissioners of His Majesty's Treasury. For the year ended 31st March, 1907. Presented to both Houses of Parliament by command of His Majesty. London, Stationery Office, 1907. Size $9\frac{1}{2} \times 6$. Pp. 150. Price 1s. 7d.

THE Report mentions that Professor W. Somerville has resigned his membership of the Committee and Professor T. H. Middleton, his

successor at the Board of Agriculture, has taken his place. The property of the former Meteorological Council (a limited company which has been wound up in accordance with the provisions of the Companies Acts) has now been vested in the Administrative Secretary of the Treasury and the Director of the Meteorological Office for the time being as Trustees for the Committee.

The Post Office, we are not surprised to learn, has not been induced to take any steps towards facilitating the dispatch of storm warnings by telegraph, nor does it seem to have thought of employing the ever-open offices of the trunk telephone exchanges for this service. So it will continue to happen that telegraph wires will occasionally be blown down before the warning of the avenging storm has been permitted to pass along them.

The Committee throws out the suggestion that a meeting of the Meteorologists of the British Empire might advantageously be held in Canada at the end of May, 1908, and there is no doubt that such a meeting would serve as a stimulus to the various meteorological services.

Various modifications have been made in the weather charts in order to give effect to the larger area from which telegraphic reports are now received, and new methods for preparing forecasts are in course of development.

A great amount of research is in progress under the auspices of the Committee, and it is evident that it takes an entirely different view of the functions of a Government Meteorological Service from that which has generally been held hitherto. This cannot fail to be of great benefit to the science and to the country if complete co-operation can be secured with other meteorological organizations, and if the great influence which the Meteorological Committee can exert is brought to bear on the amelioration of the somewhat hard conditions in which some of those bodies have to work.

Observing and Forecasting the Weather. Meteorology without Instruments.

By D. W. HORNER, F.R.Met.Soc. London, Witherby and Co., 1907. Size $7\frac{1}{2} \times 5$. Pp. 48. Price 6d. net.

MR. HORNER is an enthusiastic meteorological observer and his keen interest in the subject gives a heartiness to this booklet which many more pretentious publications do not possess. Limited to non-instrumental observations and written in a style which we may characterize as pleasantly discursive, the little work will, we are sure, suit the tastes of many who are not disposed to tackle the more formal and statistical aspects of a science which in truth deals with matters various enough to appeal in some measure to all.

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## METEOROLOGICAL NEWS AND NOTES.

DR. H. R. MILL WILL LECTURE on "Rain," in connection with the Gilchrist Educational Trust, at Normanton, on Monday, November 4th; at Cleckheaton, on Tuesday, November 5th; at Great Harwood, on Wednesday, November 6th; at Radcliffe, on Thursday, November 7th; and at Bury, on Friday, November 8th. He hopes to be able to visit rainfall observers in the adjacent parts of Yorkshire and Lancashire during the week of the lectures.

HEAVY RAINS IN SEPTEMBER and the early part of October have produced devastating floods in the south of France and of Spain. Large tracts of country in the Mediterranean departments of France have been inundated, towns have been isolated by the destruction of the connecting roads, railways, telegraphs and telephones, and immense damage has been done to property. Many lives also have been lost. We hope to give fuller particulars in an early number.

THE ALPS AS A WEATHER DIVIDE have attracted some attention on the continent. We may accordingly put on record a recent experience when entering the St. Gothard tunnel on the south side in brilliant sunshine under a cloudless sky, we emerged in thirteen minutes on the north side in a fog so dense that it was difficult to believe we had left the tunnel. The fog diminished as we descended, but the evening was dull and gloomy all the way to Bâle.

MESSRS. PASTORELLI & RAPKIN have forwarded for our inspection their Peandar set of instruments, the somewhat puzzling name representing the initials of the firm. The set is sold at the very moderate price of £6 6s. without, and £7 18s. 6d. with, Kew certificates: the additional cost should be cheerfully incurred by any purchaser as instruments without certificates are not complete for scientific purposes. The set consists of a neat Fortin pattern barometer reading by a vernier to .01 in., a wet bulb, dry bulb, maximum and minimum thermometer and a standard Snowdon rain gauge. The instruments are well made, the only criticism we have to offer on them being that the barometer should be provided with an attached thermometer, and that some form of screen for the proper exposure of the thermometers must be provided by the observer.

MESSRS. DARTON & Co. have sent us their new illustrated price list of meteorological and other instruments. The instruments, as illustrated, appear to be of good construction and moderate price. Some obsolete patterns of rain gauges appear but prominence is given to the standard patterns, and the list will interest many of our readers.

AN OLD RAINFALL OBSERVER writes to us that the state of his health making it necessary for him to cease observing, he presented his rain gauge to the authorities of a public park in the neighbourhood, hoping that they would set it up and appoint someone to look after it. "They, however," he says, pathetically, "decided to place it in the museum as a curiosity."

## TEMPERATURE FOR SEPTEMBER, 1907.

| STATION.                           | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea,<br>ft. | TEMPERATURE. |        |      |       | No. of Night-<br>ator below 32° |        |
|------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|--------|------|-------|---------------------------------|--------|
|                                    |                      |            |                      |                                | Max.         |        | Min. |       | Shade.                          | Grass. |
|                                    |                      |            |                      |                                | °            | Date.  | °    | Date. |                                 |        |
| Camden Square.....                 | London.....          | 51 32      | 0 8                  | 111                            | 80·1         | 25     | 38·0 | 23    | 0                               | 0      |
| Tenterden.....                     | Kent.....            | 51 4       | 0 41                 | 190                            | 78·0         | 13     | 39·5 | 24    | 0                               | ...    |
| West Dean.....                     | Hampshire.....       | 51 3       | 1 38                 | 137                            | 76·0         | 12     | 29·0 | 23    | 2                               | 13     |
| Hartley Wintney.....               | ".....               | 51 18      | 0 53                 | 222                            | 75·0         | 13, 17 | 30·0 | 23    | 2                               | 4      |
| Hitchin.....                       | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | 79·0         | 25     | 32·0 | 22    | 1                               | ...    |
| Winslow (Addington).....           | Buckinghamsh. ....   | 51 58      | 0 53                 | 309                            | 78·0         | 25     | 30·0 | 24    | 2                               | 3      |
| Bury St. Edmunds (Westley).....    | Suffolk.....         | 52 15      | 0 40                 | 226                            | 79·8         | 25     | 36·0 | 24    | 0                               | 2      |
| Brundall.....                      | Norfolk.....         | 52 37      | *1 26                | 66                             | 79·0         | 25     | 32·6 | 23    | 0                               | 2      |
| Winterbourne Steepleton.....       | Dorset.....          | 50 42      | 2 31                 | 316                            | 79·7         | 9      | 31·6 | 23    | 1                               | 2      |
| Torquay (Cary Green).....          | Devon.....           | 50 28      | 3 32                 | 12                             | 71·8         | 13     | 44·2 | 15    | 0                               | 0      |
| Polapit Tamar [Launceston].....    | ".....               | 50 40      | 4 22                 | 315                            | 75·5         | 8      | 34·0 | 24    | 0                               | 3      |
| Bath.....                          | Somerset.....        | 51 23      | 2 21                 | 67                             | 75·0         | 12     | 35·2 | 23    | 0                               | 0      |
| Stroud (Upfield).....              | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 73·0         | 8      | 41·0 | 23    | 0                               | ...    |
| Church Stretton (Wolstaston).....  | Shropshire.....      | 52 35      | 2 48                 | 800                            | 72·0         | 12     | 26·0 | 4     | 2                               | ...    |
| Coventry Kingswood.....            | Warwickshire.....    | 52 24      | 1 30                 | 340                            | 68·0         | 12     | 41·0 | 24    | 0                               | ...    |
| Boston.....                        | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 73·0         | 25     | 39·0 | 24    | 0                               | ...    |
| Workshop (Hodsock Priory).....     | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 75·2         | 12     | 32·2 | 24    | 0                               | 6      |
| Derby (Midland Railway).....       | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 78·0         | 28     | 34·0 | 22    | 0                               | ...    |
| Bolton (Queen's Park).....         | Lancashire.....      | 53 35      | 2 28                 | 390                            | 75·0         | 25     | 35·3 | 4     | ...                             | ...    |
| Wetherby (Ribston Hall).....       | Yorkshire, W.R. .... | 53 59      | 1 24                 | 130                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Arnccliffe Vicarage.....           | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Hull (Pearson Park).....           | "..... E.R. ....     | 53 45      | 0 20                 | 6                              | 73·0         | 12, 13 | 33·0 | 4     | 0                               | 1      |
| Newcastle (Town Moor).....         | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Borrowdale (Seathwaite).....       | Cumberland.....      | 54 30      | 3 10                 | 423                            | 77·2         | 28     | 32·9 | 4     | 0                               | ...    |
| Cardiff (Ely).....                 | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...    | ...  | ...   | ...                             | ...    |
| Haverfordwest (High Street).....   | Pembroke.....        | 51 48      | 4 58                 | 95                             | 71·4         | 12     | 38·2 | 4     | 0                               | ...    |
| Aberystwyth (Gogerddan).....       | Cardigan.....        | 52 26      | 4 1                  | 83                             | 79·0         | 25     | 29·0 | 3     | ...                             | ...    |
| Llandudno.....                     | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 73·8         | 9      | 39·5 | 4     | 0                               | ...    |
| Cargen [Dumfries].....             | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 78·0         | 28     | 29·0 | 4     | 1                               | ...    |
| Lilliesleaf (Riddell House).....   | Roxburgh.....        | 55 31      | 2 46                 | 550                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Edinburgh (Royal Observatory)..... | Midlothian.....      | 55 55      | 3 11                 | 442                            | 76·3         | 10     | 36·7 | 3     | 0                               | 0      |
| Girvan (Pinnore).....              | Ayr.....             | 55 10      | 4 49                 | 207                            | 76·0         | 28     | 30·0 | 4     | ...                             | ...    |
| Glasgow (Queen's Park).....        | Renfrew.....         | 55 53      | 4 18                 | 144                            | 70·0         | 10     | 36·0 | 2     | 0                               | 5      |
| Tighnabruach.....                  | Argyll.....          | 55 55      | 5 14                 | 50                             | 60·0         | 10†    | 34·0 | 2     | 0                               | ...    |
| Mull (Quinish).....                | ".....               | 56 36      | 6 13                 | 35                             | 74·0         | 9      | ...  | ...   | ...                             | ...    |
| Dundee (Eastern Necropolis).....   | Forfar.....          | 56 28      | 2 57                 | 199                            | 76·2         | 10     | 33·0 | 4     | 0                               | ...    |
| Braemar.....                       | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...    | ...  | ...   | ...                             | ...    |
| Aberdeen (Cranford).....           | ".....               | 57 8       | 2 7                  | 120                            | 77·0         | 10, 19 | 28·0 | 3     | 1                               | 1      |
| Cawdor.....                        | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Invergarry.....                    | E. Inverness.....    | 57 4       | 4 47                 | 132?                           | ...          | ...    | ...  | ...   | ...                             | ...    |
| Loch Torridon (Bendamph).....      | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...    | ...  | ...   | ...                             | ...    |
| Dunrobin Castle.....               | Sutherland.....      | 57 59      | 3 56                 | 14                             | 68·0         | 10     | 36·0 | 3     | 0                               | ...    |
| Castletown.....                    | Caithness.....       | 58 35      | 3 23                 | 100                            | 77·0         | 10     | 27·0 | 21    | 1                               | 1      |
| Killarney (District Asylum).....   | Kerry.....           | 52 4       | 9 31                 | 178                            | 74·5         | 22     | 42·5 | 4     | 0                               | ...    |
| Waterford (Brook Lodge).....       | Waterford.....       | 52 15      | 7 7                  | 104                            | 71·5         | 21     | 35·0 | 4     | 0                               | ...    |
| Broadford (Hurdlestown).....       | Clare.....           | 52 48      | 8 38                 | 167                            | 70·0         | 8      | 36·0 | 3     | 0                               | ...    |
| Abbey Leix (Blandsfort).....       | Queen's County.....  | 52 56      | 7 17                 | 532                            | 71·0         | 9      | 32·0 | 3     | 1                               | 3      |
| Dublin (Fitz William Square).....  | Dublin.....          | 53 21      | 6 14                 | 54                             | 71·2         | 10     | 38·7 | 4     | 0                               | 0      |
| Ballinasloe.....                   | Galway.....          | 53 20      | 8 15                 | 160                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Clifden (Kylemore House).....      | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Crossmolina (Enniscroe).....       | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...    | ...  | ...   | ...                             | ...    |
| Seaforde.....                      | Down.....            | 54 19      | 5 50                 | 180                            | 70·0         | 20     | 38·0 | 3     | 0                               | 1      |
| Londonderry (Creggan Res.).....    | Londonderry.....     | 54 59      | 7 19                 | 320                            | ...          | ...    | ...  | ...   | ...                             | ...    |
| Omagh (Edenfel).....               | Tyrone.....          | 54 36      | 7 18                 | 280                            | ...          | ...    | ...  | ...   | ...                             | ...    |

† and 20, 28, 27, 28.

## RAINFALL FOR SEPTEMBER, 1907.

| RAINFALL OF MONTH. |       |                    |          |                   |       |             | RAINFALL FROM JAN. 1. |       |                      |          |        | Mean Annual 1870-1899. | STATION. |
|--------------------|-------|--------------------|----------|-------------------|-------|-------------|-----------------------|-------|----------------------|----------|--------|------------------------|----------|
| P. 99.             | 1907. | Diff. from Av. in. | % of Av. | Max. in 24 hours. |       | No. of Days | Aver. 1870-99.        | 1907. | Diff. from Aver. in. | % of Av. |        |                        |          |
|                    | in.   |                    |          | in.               | Date. |             | in.                   | in.   |                      |          | in.    |                        |          |
| 9                  | ·62   | -1·67              | 27       | ·16               | 4     | 8           | 17·74                 | 14·56 | - 3·18               | 82       | 25·16  | Camden Square          |          |
| 2                  | ·42   | -2·20              | 16       | ·14               | 3, 4  | 6           | 18·80                 | 13·71 | - 5·11               | 73       | 28·36  | Tenterden              |          |
| 8                  | ·46   | -2·12              | 18       | ·11               | 3     | 6           | 20·41                 | 14·45 | - 5·96               | 71       | 29·93  | West Dean              |          |
| 8                  | ·61   | -1·77              | 26       | ·25               | 3     | 6           | 18·44                 | 16·20 | - 2·24               | 88       | 27·10  | Hartley Wintney        |          |
| 6                  | ·69   | -1·57              | 31       | ·22               | 2     | 9           | 17·33                 | 15·28 | - 2·05               | 88       | 24·66  | Hitchin                |          |
| 8                  | ·90   | -1·48              | 38       | ·50               | 2     | 6           | 18·96                 | 15·74 | - 3·22               | 83       | 26·75  | Addington              |          |
| 19                 | ·52   | -1·97              | 21       | ·20               | 4     | 7           | 18·12                 | 16·76 | - 1·36               | 92       | 25·39  | Westley                |          |
| 7                  | ·43   | -2·14              | 17       | ·14               | 4     | 5           | 17·58                 | 16·43 | - 1·15               | 94       | 25·40  | Brundall               |          |
| 10                 | 1·00  | -2·40              | 30       | ·42               | 4     | 7           | 25·72                 | 18·90 | - 6·82               | 73       | 39·00  | Winterbourne Stpltn    |          |
| 5                  | ·84   | -2·11              | 31       | ·48               | 26    | 9           | 23·74                 | 16·84 | - 6·90               | 71       | 35·00  | Torquay                |          |
| 53                 | 1·11  | -2·52              | 30       | ·44               | 26    | 11          | 25·20                 | 20·20 | - 5·00               | 80       | 38·85  | Polapit Tamar          |          |
| 39                 | ·49   | -2·40              | 17       | ·18               | 2     | 4           | 21·71                 | 19·63 | - 2·08               | 90       | 30·75  | Bath                   |          |
| 72                 | ·71   | -2·01              | 26       | ·29               | 2     | 5           | 21·28                 | 18·51 | - 2·77               | 87       | 29·85  | Stroud                 |          |
| 74                 | ·72   | -2·02              | 26       | ·19               | 4     | 7           | 22·95                 | 21·98 | - .97                | 96       | 33·04  | Wolstaston             |          |
| 71                 | ·68   | -2·03              | 25       | ·21               | 4     | 7           | 20·79                 | 18·43 | - 2·36               | 89       | 29·21  | Coventry               |          |
| 30                 | ·58   | -1·72              | 25       | ·18               | 4     | 8           | 16·75                 | 13·74 | - 3·01               | 82       | 23·30  | Boston                 |          |
| 18                 | ·51   | -1·67              | 23       | ·17               | 4     | 8           | 17·81                 | 14·03 | - 3·78               | 79       | 24·70  | Hodsock Priory         |          |
| 32                 | ·75   | -1·57              | 32       | ·28               | 4     | 7           | 18·85                 | 19·91 | + 1·06               | 106      | 26·18  | Derby                  |          |
| 38                 | 1·49  | -2·89              | 34       | ·58               | 4     | 12          | 29·61                 | 33·37 | + 3·76               | 113      | 42·43  | Bolton                 |          |
| 53                 | ·84   | -1·69              | 33       | ·35               | 2, 4  | 5           | 19·36                 | 17·39 | - 1·97               | 90       | 26·96  | Ribston Hall           |          |
| 13                 | 1·07  | -4·06              | 21       | ·57               | 4     | 5           | 42·00                 | 42·65 | + .65                | 101      | 60·96  | Arncliffe Vic.         |          |
| 40                 | ·70   | -1·70              | 29       | ·37               | 4     | 7           | 18·95                 | 16·02 | - 2·93               | 85       | 27·02  | Hull                   |          |
| 36                 | ·64   | -1·72              | 27       | ·33               | 4     | 7           | 19·76                 | 16·64 | - 3·12               | 84       | 27·99  | Newcastle              |          |
| 76                 | 2·03  | -10·73             | 16       | ·86               | 1     | 8           | 90·72                 | 83·14 | - 7·58               | 92       | 132·68 | Seathwaite             |          |
| 08                 | ·81   | -3·27              | 20       | ·23               | 3     | 8           | 29·31                 | 24·16 | - 5·15               | 82       | 42·81  | Cardiff                |          |
| 21                 | 1·40  | -2·81              | 33       | ·47               | 4     | 5           | 31·62                 | 26·88 | - 4·74               | 85       | 47·88  | Haverfordwest          |          |
| 20                 | 1·13  | -3·07              | 27       | ·39               | 4     | 5           | 30·66                 | 31·50 | + .84                | 103      | 45·41  | Gogerddan              |          |
| 92                 | ·22   | -2·70              | 8        | ·10               | 4     | 5           | 20·57                 | 16·43 | - 4·14               | 80       | 30·98  | Llandudno              |          |
| 71                 | ·73   | -2·98              | 20       | ·38               | 1     | 3           | 29·86                 | 31·36 | + 1·50               | 105      | 43·43  | Cargen                 |          |
| 77                 | 1·30  | ...                | ...      | ...               | ...   | ...         | 23·33                 | ...   | ...                  | ...      | 33·04  | Riddell House          |          |
| ...                | 1·30  | ...                | ...      | ·51               | 2     | 9           | ...                   | 20·98 | ...                  | ...      | ...    | Edinburgh              |          |
| 44                 | 1·72  | -2·72              | 39       | ·40               | 4     | 17          | 32·90                 | 27·68 | ...                  | ...      | 48·87  | Girvan                 |          |
| 34                 | 1·25  | -2·09              | 37       | ·36               | 4     | 13          | 25·43                 | 27·68 | + 2·25               | 109      | 35·80  | Glasgow                |          |
| 53                 | 3·53  | -2·00              | 64       | 1·30              | 1     | 11          | 39·64                 | 43·79 | + 4·15               | 110      | 57·90  | Tighnabruaich          |          |
| 47                 | 1·79  | -3·68              | 33       | ·63               | 12    | 17          | 38·53                 | 37·54 | - .99                | 97       | 57·53  | Quinish                |          |
| 55                 | 1·15  | -1·40              | 45       | ·40               | 2     | 9           | 20·75                 | 21·25 | + .50                | 102      | 28·95  | Dundee                 |          |
| 27                 | ·86   | -2·31              | 29       | ...               | ...   | ...         | 24·93                 | 21·76 | - 3·17               | 87       | 36·07  | Braemar                |          |
| 04                 | 1·21  | -1·83              | 40       | ·45               | 4     | 10          | 22·97                 | 20·60 | - 2·37               | 90       | 33·01  | Aberdeen               |          |
| 01                 | ·70   | -2·31              | 23       | ·17               | 1     | 7           | 21·34                 | 22·09 | + .75                | 104      | 29·37  | Cawdor                 |          |
| 12                 | 2·20  | -2·92              | 43       | ·48               | 6     | 8           | 37·81                 | 43·13 | + 5·32               | 114      | 56·00  | Invergarry             |          |
| 28                 | 4·02  | -4·26              | 48       | 1·01              | 6     | 16          | 57·69                 | 68·98 | + 11·29              | 112      | 86·50  | Bendamp                |          |
| 71                 | 1·04  | -1·67              | 38       | ·38               | 1     | 10          | 21·63                 | 24·85 | + 3·22               | 115      | 31·60  | Dunrobin Castle        |          |
| ...                | ·68   | ...                | ...      | ·19               | 1     | 15          | ...                   | 23·11 | ...                  | ...      | ...    | Castletown             |          |
| 67                 | 1·71  | -2·96              | 37       | ·74               | 26    | 11          | 39·57                 | 27·41 | - 12·16              | 69       | 58·11  | Killarney              |          |
| 08                 | 1·38  | -1·70              | 45       | ·45               | 26    | 8           | 27·08                 | 23·01 | - 4·07               | 85       | 39·30  | Waterford              |          |
| 94                 | 1·73  | -1·21              | 59       | ·48               | 4     | 16          | 23·79                 | 23·84 | + .05                | 100      | 33·47  | Hurdlestown            |          |
| 86                 | 1·27  | -1·59              | 44       | ·29               | 3, 4  | 9           | 25·05                 | 24·24 | - .81                | 97       | 35·19  | Abbey Leix             |          |
| 15                 | ·55   | -1·60              | 26       | ·26               | 3     | 7           | 19·68                 | 17·13 | - 2·55               | 87       | 27·75  | Dublin                 |          |
| 17                 | ...   | ...                | ...      | ...               | ...   | ...         | 26·36                 | ...   | ...                  | ...      | 37·04  | Ballinasloe            |          |
| 72                 | 3·29  | -3·43              | 49       | 1·30              | 1     | 9           | 55·06                 | 46·77 | - 8·29               | 85       | 80·23  | Kylemore House         |          |
| 12                 | 1·81  | -2·31              | 44       | ·52               | 1     | 17          | 34·02                 | 34·14 | + .12                | 100      | 50·50  | Ennisce                |          |
| 37                 | 1·41  | -1·96              | 42       | ·68               | 1     | 6           | 27·21                 | 27·62 | + .41                | 101      | 38·61  | Seaforde               |          |
| 77                 | ...   | ...                | ...      | ...               | ...   | ...         | 28·25                 | ...   | ...                  | ...      | 41·20  | Londonderry            |          |
| 55                 | ...   | ...                | ...      | ...               | ...   | ...         | 26·83                 | ...   | ...                  | ...      | 37·85  | Omagh                  |          |

## SUPPLEMENTARY RAINFALL, SEPTEMBER, 1907.

| Div.  | STATION.                          | Rain<br>inches | Div.   | STATION.                          | Rain<br>inches |
|-------|-----------------------------------|----------------|--------|-----------------------------------|----------------|
| II.   | Abinger Hall .....                | ·87            | XI.    | Rhayader, Tyrmynydd .....         | ·91            |
| "     | Ramsgate .....                    | ·41            | "      | Lake Vyrnwy .....                 | 1·00           |
| "     | Hailsham .....                    | ·71            | "      | Llangyhanfal, Plas Draw .....     | ·68            |
| "     | Crowborough, Uckfield Lodge ..... | ·95            | "      | Criccieth, Tatarvor .....         | ·55            |
| "     | Totland Bay, Aston House .....    | ·93            | "      | Llanberis, Pen-y-pass .....       | 2·00           |
| "     | Emsworth, Redlands .....          | ·58            | "      | Lligwy .....                      | ·53            |
| "     | Alton, Ashdell .....              | ·61            | "      | Douglas, Woodville .....          | 1·00           |
| "     | Newbury, Welford Park .....       | ·81            | XII.   | Stoneykirk, Ardwell House .....   | 1·30           |
| III.  | Harrow Weald, Hill House .....    | ·73            | "      | Dalry, The Old Garroch .....      | 1·06           |
| "     | Oxford, Magdalen College .....    | ·63            | "      | Langholm, Drove Road .....        | 1·00           |
| "     | Bloxham Grove .....               | ·80            | "      | Moniaive, Maxwellton House .....  | 1·05           |
| "     | Pitsford, Sedgebrook .....        | ·66            | XIII.  | N. Esk Reservoir [Penicuik] ..... | 1·45           |
| "     | Huntingdon, Brampton .....        | ·71            | XIV.   | Maybole, Knockdon Farm .....      | ·60            |
| "     | Wisbech, Bank House .....         | ·54            | XV.    | Campbeltown, Witchburn .....      | 1·65           |
| IV.   | Southend Water Works .....        | ·84            | "      | Inveraray, Newtown .....          | 2·00           |
| "     | Colchester, Lexden .....          | ·77            | "      | Ballachulish House .....          | 3·15           |
| "     | Newport, The Vicarage .....       | ·43            | "      | Islay, Eallabus .....             | 2·61           |
| "     | Rendlesham .....                  | ·76            | XVI.   | Dollar Academy .....              | 2·02           |
| "     | Swaffham .....                    | ·57            | "      | Loch Leven Sluice .....           | 1·33           |
| "     | Blakeney .....                    | ·62            | "      | Balquhider, Stronvar .....        | 1·91           |
| V.    | Bishops Cannings .....            | ·73            | "      | Perth, Pitcullen House .....      | ·84            |
| "     | Ashburton, Druid House .....      | 1·32           | "      | Coupar Angus Station .....        | ·76            |
| "     | Okehampton, Oaklands .....        | 1·02           | "      | Blair Atholl .....                | 1·13           |
| "     | Hartland Abbey .....              | 1·02           | "      | Montrose, Sunnyside Asylum .....  | 1·05           |
| "     | Lynmouth, Rock House .....        | ·84            | XVII.  | Alford, Lynturk Manse .....       | 1·16           |
| "     | Probus, Lamellny .....            | 2·25           | "      | Keith Station .....               | 1·05           |
| "     | Wellington, The Avenue .....      | ...            | XVIII. | N. Uist, Lochmaddy .....          | 2·41           |
| "     | North Cadbury Rectory .....       | ·65            | "      | Alvey Manse .....                 | ·86            |
| VI.   | Clifton, Pembroke Road .....      | ·62            | "      | Loch Ness, Drumnadrochit .....    | ·66            |
| "     | Ross, The Graig .....             | ·57            | "      | Glencarron Lodge .....            | 3·01           |
| "     | Shifnal, Hatton Grange .....      | 1·24           | "      | Fearn, Lower Pitkerrie .....      | ·75            |
| "     | Cheadle, The Heath House .....    | ...            | XIX.   | Invershin .....                   | ·84            |
| "     | Blockley, Upton Wold .....        | ·64            | "      | Altnaharra .....                  | ·93            |
| "     | Worcester, Boughton Park .....    | ·47            | "      | Bettyhill .....                   | ·81            |
| VII.  | Market Overton .....              | 1·86           | XX.    | Dunmanway, The Rectory .....      | 2·36           |
| "     | Market Rasen .....                | ·51            | "      | Cork .....                        | 2·32           |
| "     | Bawtry, Hesley Hall .....         | ·42            | "      | Darrynane Abbey .....             | 2·20           |
| VIII. | Neaton, Hinderton Lodge .....     | ·45            | "      | Glenam [Clonmel] .....            | 1·27           |
| "     | Southport, Hesketh Park .....     | ·75            | "      | Ballingarry, Gurteen .....        | 1·26           |
| "     | Chatburn, Middlewood .....        | 1·17           | "      | Miltown Malbay .....              | 3·16           |
| "     | Cartmel, Flookburgh .....         | ·79            | XXI.   | Gorey, Courtown House .....       | 1·39           |
| IX.   | Langsett Moor, Up. Midhope .....  | ·78            | "      | Moynalty, Westland .....          | 1·43           |
| "     | Scarborough, Scalby .....         | ·53            | "      | Athlone, Twyford .....            | 1·63           |
| "     | Ingleby Greenhow .....            | ·57            | "      | Mullingar, Belvedere .....        | ·86            |
| "     | Mickleton .....                   | ·29            | XXII.  | Woodlawn .....                    | 1·64           |
| X.    | Bardon Mill, Beltingham .....     | ·41            | "      | Westport, Murriak Abbey .....     | ...            |
| "     | Ewesley, Fallowles .....          | ·37            | "      | Collooney, Markree Obay .....     | 1·76           |
| "     | Ilderton, Lilburn Cottage .....   | ·38            | "      | Mohill .....                      | 1·87           |
| "     | Keswick, York Bank .....          | ·56            | "      | Enniskillen, Portora .....        | 1·19           |
| XI.   | Llanfrechfa Grange .....          | ·92            | XXIII. | Warrenpoint, Summer Hill .....    | 1·07           |
| "     | Treherbert, Tyn-y-waun .....      | 2·32           | "      | Banbridge, Milltown .....         | ·99            |
| "     | Carmarthen, The Friary .....      | ·90            | "      | Belfast, Springfield .....        | 1·37           |
| "     | Castle Malgwyn [Llechryd] .....   | ·92            | "      | Bushmills, Dundarave .....        | 1·55           |
| "     | Plynlimon .....                   | 1·60           | "      | Stewartstown, The Square .....    | ·80            |
| "     | Crickhowell, Fordlas .....        | 1·20           | "      | Killybegs .....                   | 2·55           |
| "     | New Radnor, Ednol .....           | ·88            | "      | Horn Head .....                   | 1·45           |

## METEOROLOGICAL NOTES ON SEPTEMBER, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—After the first week, which was somewhat unsettled, occurred the finest spell of the summer, with warm sunny days, and, except on 25th, no R from 7th to 29th. The mean temp. was  $58^{\circ}\cdot5$ , or  $0^{\circ}\cdot8$  above the average. Duration of sunshine  $143\cdot9^*$  hours, and of R  $12\cdot2$  hours.

TENTHEDEN.—Dry, warm, and generally sunny after 6th. The R was the least since 1865. Duration of sunshine  $197\cdot\dagger$  hours.

CROWBOROUGH.—Splendid weather from 7th, with considerable sunshine, and only  $\cdot12$  in. of R. The total fall was  $1\cdot96$  in. below the average of 36 years. Mean temp.  $58^{\circ}\cdot5$ , or  $1^{\circ}\cdot7$  above the average.

BURY ST. EDMUNDS.—The most delightful month of the year, warm, with much sunshine, little wind, and 22 days in succession without R. Splendid harvest weather.

TORQUAY.—Duration of sunshine  $172\cdot0^*$  hours, or  $4\cdot7$  above the average. Mean temp.  $59^{\circ}\cdot7$ , or  $1^{\circ}\cdot4$  above the average.

CLIFTON.—Fine and dry, with much sunshine, and absolute drought from 6th to 30th. The driest September since 1865.

BOLTON.—Duration of sunshine  $84\cdot4^*$  hours, or  $3\cdot4$  below the average, owing to frequent heavy mists. Mean temp.  $55^{\circ}\cdot4$ , or  $1^{\circ}\cdot4$  above the average. No R fell from 5th to the end.

SOUTHPORT.—The driest September in 36 years' record, the fall being  $2\cdot45$  in. below the average of 35 years. Duration of sunshine  $128^*$  hours, or 15 hours below the average, largely owing to haze; duration of R  $12\cdot3$  hours.

CARMARTHEN.—Remarkably fine and bright, with abundant sunshine, and no R from 8th to 29th, inclusive. Partridges as a rule were scarce owing to the wet June, but pheasants seemed more promising. Corn and potatoes were well harvested.

HAVERFORDWEST.—No R from 7th to the end. Duration of sunshine  $175\cdot2^*$  hours.

DOUGLAS.—The outlook at the beginning seemed hopeless, and the first five days were a prolongation of the lamentable weather of the previous three months, but there was a wonderful and quite unlooked for change on 6th, and from this date until 29th was an unbroken spell of magnificent weather, warm, sunny, calm, and very dry, to which gardens responded in a remarkable way.

DUMFRIES.—The R has been less in September twice only in 48 years, but although R was absent the weather was unfavourable for harvest operations, heavy dews and absence of wind preventing drying of stooks. Frost on 4th caused immense damage in gardens and to potatoes.

COUPAR ANGUS.—R 38 per cent. of the average, and mean temp.  $53^{\circ}\cdot8$ , or  $1^{\circ}\cdot7$  above the average. The month opened with slight frosts, followed by calm and bright sunny days.

ABERDEEN.—Remarkably fine, bright and warm. The cereal crops which at the end of August were quite green ripened fast, and harvesting was general by the end of September.

DRUMNADROCHIT.—R  $1\cdot98$  in., and rain days 6, below the average of 21 years. Unusually grand aurora on 10th.

BALLINGARRY.—A lovely month from 5th till 25th, with several hot days and no R. Harvest was begun and nearly finished in this period.

MILTOWN MALBAY.—Heavy R in the first and last weeks, but the middle was fair for harvesting, and the temp. was high throughout.

DUBLIN.—Opening with a broken and rainy spell the month proved fine, warm and genial, with absolute drought from 15th. Mean temp.  $57^{\circ}\cdot8$ , or  $1^{\circ}\cdot9$  above the average of 35 years.

MARKREE.—With the exception of the first week, which was very wet, it was unusually fine, dry and mild. The duration of sunshine was small owing to fog.

\* Campbell-Stokes.

† Jordan.



## Climatological Table for the British Empire, April, 1907.

| STATIONS.<br><br>(Those in <i>italics</i> are<br>South of the Equator.) | Absolute. |       |          |         | Average. |      |               |           | Absolute.       |                   | Total Rain. |       | Aver.<br>Cloud. |
|-------------------------------------------------------------------------|-----------|-------|----------|---------|----------|------|---------------|-----------|-----------------|-------------------|-------------|-------|-----------------|
|                                                                         | Maximum.  |       | Minimum. |         | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Max. on<br>Grass. | Depth.      | Days. |                 |
|                                                                         | Temp.     | Date. | Temp.    | Date.   |          |      |               |           |                 |                   |             |       |                 |
| London, Camden Square                                                   | 73·4      | 24    | 30·8     | 19      | 56·2     | 40·0 | 41·1          | 81        | 120·7           | 27·6              | inches 3·22 | 18    | 4               |
| Malta ... ..                                                            | 75·2      | 28    | 49·8     | 6       | 62·0     | 53·3 | 49·2          | 74        | 139·2           | ...               | 1·29        | 8     | 5·0             |
| Lagos ... ..                                                            | 91·0      | 30    | 71·0     | 1       | 87·8     | 76·6 | 75·2          | 75        | 161·0           | 70·0              | 6·07        | 9     | 7·7             |
| Cape Town ... ..                                                        | 84·4      | 3     | 48·4     | 20      | 71·2     | 55·2 | 53·2          | 73        | —               | —                 | 1·94        | 8     | 5·2             |
| Durban, Natal ... ..                                                    | 84·2      | 28    | 57·6     | 28, 26  | 77·4     | 62·2 | ...           | ...       | 143·2           | ...               | 9·39        | 19    | 5·0             |
| Johannesburg ... ..                                                     | 72·6      | 9     | 43·2     | 26      | 64·6     | 49·3 | 50·4          | 84        | 149·9           | 37·5              | 2·91        | 12    | 4·5             |
| Mauritius ... ..                                                        | 84·4      | 15    | 61·8     | 29      | 81·5     | 69·9 | 68·5          | 80        | 144·3           | 55·0              | 8·51        | 17    | 6·9             |
| Calcutta ... ..                                                         | 103·3     | 25    | 67·2     | 2       | 93·4     | 73·9 | 70·3          | 69        | 157·7           | 61·2              | 1·25        | 5     | 5·3             |
| Bombay ... ..                                                           | 92·5      | 2     | 76·0     | 4       | 89·7     | 78·6 | 72·6          | 71        | 141·0           | 69·9              | ·06         | 3     | 4·2             |
| Madras ... ..                                                           | 97·4      | 30    | 71·6     | 12      | 92·4     | 76·6 | 74·4          | 78        | 147·0           | 69·6              | ·12         | 2     | 3·4             |
| Kodaikanal ... ..                                                       | 73·4      | 24    | 48·1     | 4       | 67·3     | 52·2 | 50·4          | 77        | 141·4           | 37·2              | 6·26        | 16    | 3·4             |
| Colombo, Ceylon ... ..                                                  | 91·4      | 9     | 71·4     | 10      | 89·5     | 75·4 | 73·4          | 75        | 155·8           | 69·8              | 6·16        | 16    | 4·6             |
| Hongkong ... ..                                                         | 81·7      | 13    | 53·9     | 1       | 72·9     | 65·7 | 64·8          | 84        | 136·7           | ...               | 11·76       | 16    | 8·6             |
| Melbourne ... ..                                                        | 90·0      | 4     | 43·0     | 3       | 65·8     | 50·6 | 46·3          | 69        | 141·1           | 32·0              | 2·33        | 14    | 7·7             |
| Adelaide ... ..                                                         | 92·4      | 4     | 45·0     | 17      | 69·8     | 52·5 | 48·9          | 66        | 142·0           | 37·8              | 2·26        | 16    | 6·1             |
| Coolgardie ... ..                                                       | 96·2      | 3     | 45·0     | 18, 26  | 75·8     | 54·0 | 43·1          | 51        | 164·3           | 39·0              | ·00         | 0     | 1·8             |
| Sydney ... ..                                                           | 81·9      | 2     | 49·1     | 27      | 73·0     | 57·0 | 52·4          | 71·4      | 116·9           | 39·2              | 1·50        | 15    | 3·6             |
| Wellington ... ..                                                       | 73·5      | 16    | 42·4     | 30      | 63·5     | 53·3 | 50·5          | 76        | 118·0           | 34·0              | 2·73        | 16    | 6·7             |
| Auckland ... ..                                                         | 75·0      | 9     | 45·0     | 30      | 69·3     | 57·3 | 54·6          | 74        | 130·0           | 41·0              | 2·84        | 13    | 5·3             |
| Jamaica, Negril Point.                                                  | 88·2      | 16    | 63·2     | 4       | 84·2     | 69·8 | 67·6          | 71        | ...             | ...               | 1·29        | 6     | ...             |
| Trinidad ... ..                                                         | 93·0      | 21    | 65·0     | several | 88·1     | 68·3 | 70·8          | 79        | 159·0           | 60·0              | ·09         | 1     | ...             |
| Grenada ... ..                                                          | 86·8      | 12    | 71·0     | 9       | 85·0     | 73·4 | 66·4          | 65        | 149·2           | ...               | 1·29        | 10    | 3·3             |
| Toronto ... ..                                                          | 70·0      | 29    | 17·6     | 2       | ...      | ...  | ...           | ...       | ...             | ...               | 2·09        | 11    | 0·6             |
| Fredericton ... ..                                                      | 68·0      | 30    | 11·0     | 8       | ...      | ...  | ...           | 66        | ...             | ...               | 4·89        | 8     | 0·6             |
| St. John's, N.B. ... ..                                                 | 52·3      | 28    | 13·5     | 7       | ...      | ...  | ...           | ...       | ...             | ...               | 4·51        | 16    | 0·7             |
| Victoria, B.C. ... ..                                                   | 67·3      | 21    | 32·2     | 28      | ...      | ...  | ...           | ...       | ...             | ...               | 1·39        | 8     | 0·5             |
| Dawson ... ..                                                           | 61·0      | 27    | -29·5    | 1       | ...      | ...  | ...           | ...       | ...             | ...               | ·23         | 8     | 0·4             |

MALTA.—Mean temp. of air 58°·2. Mean hourly velocity of wind 12·4 miles.  
 NATAL.—Rainfall 6·50 in. above the average and the heaviest fall in the month of April for 34 years.

Johannesburg.—Bright sunshine 195·6 hours, or 57 per cent. of the possible amount.

MAURITIUS.—Mean temp. of air equal to, dew point 0°·3, and relative humidity 1·2 per cent. below, and R 3·50 in. above, averages.

MADRAS.—Bright sunshine 255·3 hours. TSS on 2 days.

KODAIKANAL.—Bright sunshine 201 hours.

COLOMBO.—Mean temp. of air 82°·3 or 0°·3 below, of dew point 1°·1 below, and R 4·50 in. below, averages. Mean hourly velocity of wind 5·6 miles per hour.

HONGKONG.—Mean temp. of air 69°·2. Bright sunshine 78·3 hours. R 6·2 in. above, and sunshine 30·8 hours below, averages. Mean hourly velocity of wind 13·5 miles.

ADELAIDE.—Mean temp. of air 2°·9 below, and R 4·1 in. above, averages.

SYDNEY.—Mean temp. of air 0°·1 below, and R 3·95 in. below, averages.

WELLINGTON.—Mean temp. of air 1°·8 above, and R 0·4 in. below averages. Bright sunshine 153·6 hours.

TRINIDAD.—R 2·03 in. below 43 years' average.

# Symons's Meteorological Magazine.

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## HYGROSCOPES.

By JOHN AITKEN, LL.D., F.R.S.

IN recent numbers of your Magazine you have described and illustrated some hygrosopes. The one described in your number for February last is an ingenious method of using our old friend the



awn of the sterile oat, the twisting and untwisting of which is made to alter the position of the wings of an artificial butterfly. This awn was long ago used for making some of the hygrosopes which were fitted into the lower part of old-fashioned wheel barometers, where, of course, they were utterly useless, owing to being closely confined in the hollow in the frame cut out for them and covered with glass, and therefore cut off from all communication with the outer air. Besides this awn there are many other organic substances capable of indicating a change in the humidity of the atmosphere. One of these, which I have never seen referred to anywhere, and which I have used for many years and found very sensitive—much more so than the awn of the sterile oat—it is made of a petal of one of the so-called everlasting flowers. Though the petals of any of these flowers can be used, yet I think those of *Acroclinium roseum*, or *album*, will be found to be the most suitable.

In the lower part of the illustration is shown an instrument which has been used for many years. At the top left-hand corner is shown a flower of *Acroclinium*, and at the top right corner are three petals taken from another flower; two of these are shown edge-on, the third broadside. The petal to the left is fairly dry, while the middle one is not so dry, and if it had been in saturated air there would have been no break in the curvature; the upper and lower parts of the petal would have formed a continuous curve, the upper part coming to nearly a horizontal position. The curious point in this mechanism is that the sensitive area is extremely short, and forms practically an elbow joint, the upper part of the petal hinging on the lower part, which is fixed in the top of the flower stalk. By this mechanism the flower is enabled to open and close its petals with every change in the humidity of the atmosphere.

In the instrument shown in the lower part of the illustration a short pillar is screwed into the base-plate near the centre, and to this is attached a spring clip as shown. A petal having been selected from a flower, most of it is cut away above the sensitive part and a stiff hair cemented in its place to act as a pointer, and what was the base of the petal is inserted into the clip. The instrument is then put under a glass cover, which has been wetted inside to saturate the air. After the pointer ceases to move the centre pillar is turned so as to bring the pointer to zero on the scale.

This instrument is just about as sensitive as a hair hygroscope, and has advantages over it. It is much more compact, has no mechanism to get out of order or to cause friction, and is much cheaper. The instrument should be fitted in an open metal-work case, or the cover must be opened when in use if not fully ventilated. Nothing but metal should be used in the construction of the case. For the scale, paper should be avoided, owing to its power of absorbing and giving out moisture, which retards the movements of the hygroscope.

## THE RAINFALL OF OCTOBER, 1907.

A WET October is no new thing, for in the British Isles that month has on the average the heaviest general rainfall of the twelve; but, probably in contrast with the remarkable dryness of September, the wetness of October, 1907, has acquired a certain notoriety which will, we think, be short-lived. Our correspondence pages bear witness to the very heavy falls of rain which occurred in various parts of the country on the 16th, accompanying the passage of a deep depression from south to north, and but for that day and the 28th the rainfall of October would hardly have exceeded the average in most parts of the country.

The tables at the end of this number give details of the actual rainfall at a large number of stations, and the returns from four times as many are utilized in producing the accompanying map of the October rainfall. It will be observed that the north of Scotland is remarkably dry, indeed the whole country north of the Great Glen had less than the average, and in some parts less than half the average. There was a relatively dry belt stretching southward and eastward from Lancashire, where the rainfall was below the average at some points; and in London and its immediate neighbourhood, to the north-east, the rainfall also failed to reach the average.

On the other hand the south and east of Scotland, the greater part of England, and the south and east of Ireland, had an excess of more than fifty per cent. of rain, and there were two extensive areas—in the south of Scotland and in the south of England respectively—where more than twice the average rainfall for the month was precipitated. In those areas the fall was, in some instances, unprecedentedly great in records extending over more than thirty years.

The map now reproduced may be compared with that of the extraordinarily wet October of 1903 (Vol. 38, p. 170), which was probably the wettest on record for the country as a whole, and although a few stations had more rain in October, 1907, than in October, 1903, the country as a whole had greatly less. Last month only a few patches with more than 10 inches of rain occurred as compared with large areas in 1903, and the areas over 8 and over 6 inches were also restricted, though the latter were sufficiently extensive to be remarkable in the South of England and over the Pennine Chain. In the South of Scotland the October rainfall approaches more nearly to that of 1903 than in any other part of the country. Unfortunately several of the records available four years ago have come to an end, but we can compare a certain number.

It is apparent from the table that while in the west of Scotland the rainfall of October, 1903, was several inches greater than that of 1907, the relation is reversed in the Lothians, where the rainfall of last month exceeded that of October, 1903, by between one and two inches, and is, we believe, the greatest that has been recorded in the Edinburgh district since observations began.



RAINFALL OF OCTOBER, 1907.

|       |                              | Rainfall of October, |       | Oct., 1903, | Oct., 1907, |
|-------|------------------------------|----------------------|-------|-------------|-------------|
|       |                              | 1903.                | 1907. | Wetter by   | Wetter by   |
|       |                              | in.                  | in.   | in.         | in.         |
| XII.  | Cargen [Dumfries].....       | 10.40                | 8.59  | 1.81        |             |
| "     | Dalry, Old Garroch .....     | 12.34                | 10.08 | 2.26        |             |
| "     | Langholm .....               | 11.85                | 7.34  | 4.51        |             |
| "     | Moniaive, Maxwellton House   | 11.59                | 9.14  | 2.49        |             |
| XIII. | Selkirk, The Hangingshaw...  | 10.12                | 6.42  | 3.70        |             |
| "     | Edinburgh, Roy. Observatory  | 5.72                 | 7.90  | ...         | 2.18        |
| "     | West Linton, Rutherford Ho.  | 8.11                 | 8.97  | ...         | .86         |
| "     | N. Esk Reservoir [Penicuik]  | 7.90                 | 9.00  | ...         | 1.10        |
| "     | Whittinghame Gardens .....   | 7.09                 | 9.08  | ...         | 1.99        |
| "     | Boghead .....                | 8.54                 | 9.81  | ...         | 1.27        |
| XIV.  | Colmonell .....              | 9.01                 | 6.91  | 2.10        |             |
| "     | Glasgow, Queen's Park .....  | 7.47                 | 6.66  | .81         |             |
| XV.   | Tighnabruich .....           | 10.61                | 7.31  | 3.30        |             |
| XVI.  | Loch Leven Sluice.....       | 7.55                 | 6.77  | .78         |             |
| "     | Dundee, Eastern Necropolis.. | 5.30                 | 5.20  | .10         |             |
| "     | Balquhider, Stronvar.....    | 15.58                | 5.67  | 9.91        |             |

The effect of the heavy rain on the harvest in Scotland has been disastrous, the splendid crops, which at the end of September were almost ready for cutting, having been totally lost in many parts of the country.

The dull cold summer, with many rain days, followed by this wet October, have created a general impression that 1907 has so far proved a very wet year. The data before us are not complete, but we think that there is good ground for the statement, based on the records published in our pages, that although the rainfall for the ten months in Scotland exceeds the average by about 7 per cent., in Ireland it just reaches the average, and in England and Wales it falls short of the average by something like 4 per cent. It thus depends on the rain of November and December whether the year will have to be recorded as wet or dry.

## ON A REPRESENTATION OF THE TEMPERATURE CYCLE OF THE SEASONS.

By L. C. W. BONACINA, F.R.Met.Soc.

THE following investigation may serve to elucidate the nature and peculiarities of that cycle of atmospheric temperature changes which differentiate the seasons. There need to be considered only two agencies which control the temperature of the Earth's atmosphere as a whole: (a) the reservoir of heat or furnace, (b) the receiver of heat or refrigerator. The reservoir of heat for the atmosphere is, of course, the sun; the refrigerator of the atmosphere is properly the land and water surface of the globe, for although it is this surface which communicates to the lower layers of the atmosphere most of the heat which the latter derives from the sun, it is likewise this very surface which is always ready to act as a source of cold by radiating back into space the energy received from the reservoir.

These two agencies, then, are in constant antagonism, and operate through the transmission in opposite directions of radiant energy. How they produce the characteristic effects in the four seasons will now be shown. Let only one hemisphere, say the northern, be considered. During the winter season, which for the present investigation is best defined as lying between the winter solstice about December 22nd and the vernal equinox about March 20th, the reservoir is transmitting only a small quantity, relatively speaking, of heat, so that so far as the northern hemisphere is concerned the temperature of the reservoir may be regarded as low, although constantly increasing throughout the period.

At the same time the refrigerator is at a lower temperature than in any other season, and inasmuch as the amounts of heat gained and lost by it during this epoch are approximately equal, the atmosphere may be regarded in this relation as being in a state of low temperature equilibrium, the months of January and February being the coldest of the year. From March 20th to June 21st—that is to say, during the spring season—the reservoir furnishes as much heat as it does during the following summer season, and its temperature may therefore be regarded as high and as increasing till the end of the period at the summer solstice when it reaches its maximum. The refrigerator is at a low temperature at the commencement of the period (March 20th), and gradually gaining more heat than it loses, has, by the advent of the summer solstice acquired a relatively high temperature. Further, the temperature conditions of the lower atmosphere in spring, being the product of the action of strong solar radiation upon a cold land or water surface, are markedly unstable.

In the period from about June 21st to September 23rd, which constitutes the summer season, the reservoir is at a high but constantly declining temperature; the refrigerator is likewise, as compared with winter, at a high temperature, and since it loses approximately as much heat as it gains, the lower atmosphere is now at a high temperature equilibrium, July and August being the warmest months of the year.

In autumn, which lasts from about September 23rd to about December 22nd, the reservoir is still diminishing the output of heat, its temperature reaching a minimum at the winter solstice, whilst a steady leakage of heat takes place from the refrigerator, which begins warm and ends cold. The cooling of the refrigerator must, of course, be communicated to the lower atmosphere, but the latter does not in autumn, for a reason to be shortly indicated, exhibit the temperature instability so conspicuous in spring.

The following tabulation affords an insight into the reason of two interesting peculiarities by which the normal temperature cycle of the seasons is characterised. These are: (1) the large daily range of atmospheric temperature in summer as compared with winter; (2) the different manner in which the atmosphere becomes heated and cooled in spring and autumn respectively.

|                             | Reservoir of Heat (furnace),<br>i.e., the Sun.       | Receiver of Heat<br>(refrigerator), i.e., the<br>land and water surface<br>of the globe. | Atmosphere of the<br>Earth.                              |
|-----------------------------|------------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------|
| WINTER<br>(Dec. 22–Mar. 20) | Amount of heat trans-<br>mitted small;<br>increasing | Loss and gain of<br>heat equal                                                           | Low temperature<br>equilibrium                           |
| SPRING<br>(Mar. 20–June 21) | „ „ „ large;<br>increasing                           | Gain greater than<br>loss                                                                | Temp. rises irregu-<br>larly                             |
| SUMMER<br>(June 21–Sep. 23) | „ „ „ large;<br>decreasing                           | Loss and gain<br>equal                                                                   | High temperature<br>equilibrium                          |
| AUTUMN<br>(Sep. 23–Dec. 22) | „ „ „ small;<br>decreasing                           | Loss greater than<br>gain                                                                | Temp. falls more<br>regularly than it<br>rises in spring |

As to (1), the greater difference shown by meteorological records between the mean temperatures of day and night in summer than in winter follows on the principle of Newton's *law of cooling*, as a little reflection will suggest. The case of (2) deserves more consideration as it is less easily accounted for. Soon after the vernal equinox solar radiation becomes powerful and of long daily duration, and soon after the autumnal equinox it becomes feeble and of short daily duration; but the receiving surface of the northern hemisphere—i.e., the refrigerator of the lower atmosphere—is cold at the former date and warm at the latter, having the summer surplus of heat to get rid of in the form of dark radiant energy. There is, consequently, a much greater difference in April and May than in October and November between the amounts of heat already possessed by the refrigerator and the amounts in the form of solar radiant energy to which it is exposed.

The period from March to June, proverbially treacherous in its meteorological character, is normally marked in most temperate countries by a series of sudden spurts of high temperature frequently followed by a speedy relapse into the cold of winter. In other words, this irregular and capricious mode of arrival of summer warmth is due to the difficulty experienced by the powerful solar radiation of April and May in defeating the tendency of the refrigerator to retain in the atmosphere the low-level temperature of winter. In October and November, on the contrary, when the sun's rays are feeble, and the office of the refrigerator is to cool the atmosphere by parting with its own summer store of heat, the onslaught of the cold of winter is, except in so far as it may be interfered with by general meteorological causes or particular types of weather, much more regular and gradual, and a steady leakage of heat marks the recession of the vertical sun into the southern hemisphere. This exposition is a general representation of the temperature cycle of the seasons for the globe as a whole, without reference to the distinctive characteristics or anomalies of the cycle over any particular region.



## Correspondence.

To the Editor of Symons's Meteorological Magazine.

## THE COLD SNAP IN SCOTLAND ON OCTOBER 8th.

THE sudden access of low temperature over Scotland on October 8th, 1907, was a highly instructive phenomenon from the meteorological point of view. The Weather Chart of the Deutsche Seewarte showed that on that morning there was no frost in any other part of Europe, not even in the most northerly regions, including Iceland, Lapland, and northern Russia. At Wick, a temperature of  $-2.26^{\circ}\text{C}$ . ( $27^{\circ}\text{F}$ .)<sup>\*</sup> was recorded, at Stornoway  $-0.6^{\circ}\text{C}$ . ( $31^{\circ}\text{F}$ .), whilst at Aberdeen the temperature was  $+1.1^{\circ}\text{C}$ . ( $33^{\circ}\text{F}$ ). Along the whole east of England, even though the wind was westerly, the recorded temperatures were less than  $3^{\circ}\text{C}$ . ( $38^{\circ}\text{F}$ .), and this at a time of year when the warming influence of the sea is still fully operative. The surrounding water was warm enough to influence the temperature of the air over the coasts affected by sea winds, as is shown by observations of  $6.7^{\circ}\text{C}$ . ( $44^{\circ}\text{F}$ .) at Thorshavn,  $7.8^{\circ}\text{C}$ . ( $45^{\circ}\text{F}$ .) at Valencia,  $8.5^{\circ}\text{C}$ . at Westervig, on the west of Denmark, and  $8.2^{\circ}\text{C}$ . at Oxö in the south of Norway.

Whence then came the cold snap in Scotland? The weather chart shows three areas of low pressure, as indicated by the isobar of 750 mm. ( $=29.54\text{ in.}$ ); one over Ireland, one over the North Sea, and one over the Norwegian Sea, which were drawing in the air from all sides. Scotland, however, lay under a little anticyclone, which might, perhaps, be represented by the isobar of 752.5 mm. ( $=29.63\text{ in.}$ ). In this way the air from the west of Scotland was being drawn over towards Ireland; that in the east of Scotland was being drawn south-eastward to the North Sea; and that over Orkney and Shetland north-eastward towards the Norwegian Sea. In order to take the place of this outdraught on all sides, it was necessary for the air in the little Scottish anticyclone to be replenished from above, and in Autumn the upper air is cold enough to produce a frost on the surface, in spite of the dynamical heating which it undergoes in its descent, the clear sky and dry upper air favouring nocturnal radiation.

Similar phenomena have occurred over the Cimbrian peninsula when cyclones lay simultaneously over the North Sea and the western Baltic, and air from above has descended to replace that drawn away to opposite sides; but I have never seen so striking an instance as that of October 8th in Scotland.

The Weather Chart of the Deutsche Seewarte for October 24th, at 8 a.m., supplies an *experimentum crucis* as to my theory of the frost of October 8th. This time there are two barometrical depressions,

<sup>\*</sup> The temperatures in brackets are those recorded in the *Daily Weather Report* for October 8th, not the exact equivalents of the Centigrade temperatures.

one in the North Sea, the other in the Bristol Channel, and between them a region with a relatively strong descending current of cold air, from which comes a record of 32° F. and fog at Skegness.

*The University, Kiel, October 25th, 1907.*

O. KRÜMMEL.

[The *Daily Weather Report* of our Meteorological Office does not show the low-pressure area over the North Sea on October 8th, though the low-pressures over Ireland and the Norwegian Sea are clearly brought out. It shows an area with less than 30° F. in the north-east of Scotland, while the isotherm of 40° includes the centre of Great Britain from north to south, and reappears in no other part of Europe except the middle of Ireland and Iceland. The *Daily Weather Report* of October 25th shows a low-pressure area over Ireland and another in the Norwegian Sea, but none in the North Sea; temperatures under 40° are indicated both in the east of Scotland and the east of England, elsewhere only in Iceland and northern Scandinavia. It must be remembered that the isobars on these charts are drawn from a very small number of points, and it often happens that when drawn for different units, *e.g.*, one set for intervals of 5 mm. another for intervals of 0.1 in., the same data may not give exactly the same outlines. Professor Krümmel's theory is in our opinion supported as well by the British chart as by the German chart which suggested it.—ED. S.M.M.]

### HEAVY RAIN OF OCTOBER 16th—17th.

In case you should be investigating the rainfall of October 16th—17th, I send you my figures.

Rain began about 7 p.m. on October 16th, and ended about noon on the 17th; very little fell before 9 p.m. or after 11 a.m., the heaviest was probably between 5 and 6 a.m.

|                      | 7 p.m.<br>to 9 a.m. | 9 a.m.<br>to noon. |            |
|----------------------|---------------------|--------------------|------------|
| Harewood Lodge ..... | 2.15                | 0.50               | = 2.65 in. |
| Royd Edge .....      | 2.13                | 0.59               | = 2.72 in. |

The fall of 2.65 in. in 17 hours (most of it in 14 hours) has, I think, only been exceeded once in my register, *viz.*, in 1901, 3.06 in. in 16 hours, from November 11th, 8.30 p.m., to November 12th, 12.30 p.m.

Other heavy falls, not of thunderstorm type, are:—1883, January 28th, 10.30 a.m., to 29th, 10.30 a.m., 2.35 inches, which owing to the then position of the gauge is too small and requires an addition of from 10 to 15 per cent.; 1890, November 22nd—23rd, 36 hours, 2.43 in.; 1892, October 14th, 4 a.m., to 15th, 10 p.m., continuous rain 42 hours, 4.00 inches, of which 2.31 in. in 24 hours ending 15th at 9 a.m.; 1907, October 16th, 7 p.m., to 17th, 12 noon, 2.65 inches in 17 hours.

CHARLES L. BROOK.

*Harewood Lodge, Meltham, Yorks, Oct. 19th, 1907.*

THE rainfall for the 24 hours ending at 9.30 this morning was 3·67 in., which is nearly four times as much as the previous heaviest fall this year, *viz.*, ·93 in. on 20th April. My position is about 356 feet above sea level.

CHARLES F. SELBY.

*Ravensbourne, Stoke Fleming, Nr. Dartmouth, 17th Oct., 1907.*

THE rainfall registered here about 8.30 a.m. yesterday, the 17th October, was 3·41 inches. In my return to you at the end of the year this will appear as on the 16th October. My previous highest record was 1·65 inches on the 16th October, 1898.

A gale is now blowing with heavy rain, 11 a.m.

LEWIS KARSLAKE.

*Redlap House, Nr. Dartmouth, 18th Oct., 1907.*

I AM told that the rainfall in this neighbourhood in the 24 hours between 9 a.m. on Wednesday, October 16th, and 9 a.m. on Thursday, October 17th, was very unusual, and that we ought to report it to you. At "Fallapit" (Lord Ashcombe's place), East Allington, the rain gauge registered 4·63 during that 24 hours, and at Kingsbridge, 4½ miles off, where Mr. Latham, solicitor and architect, keeps a register also, it was 4·86. At Salcombe it was only 2·30, and the same at Torquay.

A. D. MALLOCK.

*East Allington Rectory, S.O., S. Devon, Nov. 2nd.*

It MAY interest you to know that the rainfall here during the last 24 hours is 4·86 inches, at an elevation of 100 feet above sea level. I believe that the greatest amount previously recorded here during the last 40 years was 2·10 in. in any 24 hours.

T. W. LATHAM.

*Westcombe, Kingsbridge, S. Devon, Oct. 17th, 1907.*

### THE GREENWICH SUMMER OF 1907.

A FEW notes on this may be acceptable. It might be described as decidedly cool and moderately dry. All the three months were cool; and on 69 of the 92 days (25 in June, 26 in July and 18 in August) the thermometer never got above the seventies; though it did once in May, and once in September. Few years have had so few of those hot days: we find 2 (each) in '41 and '53, one in '62 and '79, none in '60.

Some months ago I noted (in a contemporary) that where, as this year, the first three months were dry, the summer was generally dry (10 cases out of 12). The recent summer conforms to this.

The combination—a cool and dry summer—is rather rare, but less rare than that other, a warm and wet summer. On analysis of the records, 1841–1906, I find this:

|                             |    |
|-----------------------------|----|
| 1. Warm and dry summers ... | 28 |
| 2. Cool and wet summers ... | 21 |
| 3. Cool and dry summers ... | 11 |
| 4. Warm and wet summers ... | 5  |

(this leaves one case of average temperature). The third kind are thus one in 6; the fourth about one in 13.

Those cool and dry summers were: 1844, '54, '62, '63, '64, '69, '82, '83, '85, '86, '89 (thus, mostly in the sixties and eighties).

The warm and wet summers were: '52, '65, '73, '78, 1905. Curiously, these were all of the same type, *viz.*, June and August wet, July dry.

ALEX. B. MACDOWALL.

### THE BROCKEN GHOST.

THE Brocken Ghost may often be seen on damp evenings such as November brings. When the night air is laden with mist anyone who will stand at the open window, having placed a candle behind him, will see a huge dim shadow thrown out upon the mist—and very weird the effect often is.

A. F.

### HAILSTONES.

ON October 11th, between 2 p.m. and 2.30 p.m., a sharp thunderstorm passed over this neighbourhood from S.W. to N.E., being accompanied by a heavy fall of hail lasting five minutes, from 2.5 p.m. to 2.10 p.m. The hailstones, although not of exceptional size, were of distinct formations. In the less common form the stone was composed of dull ice except at one side, where a small portion was clear. One base was markedly larger than the other.

In the other form there was a hard nucleus of dull ice surrounded by a radiated structure. This, again, was enclosed by rings of clear ice with a thin division between them, the edge was sharp and pointed although somewhat brittle. Some idea of the durability of the hailstones is brought out by the fact that five hours after the storm they were still to be found in sheltered spots, despite the fact that there was no material depression of temperature.

Fork-lightning of a deep blue hue was prevalent during the storm. From a number of observations I have obtained of thunderstorms accompanied by hail, it is a somewhat remarkable feature that the phenomena when occurring together are in almost every case accompanied by lightning of which the predominant colour is blue.

SPENCER C. RUSSELL.

Parkside, Ashley Road, Epsom, October 31st, 1907.

## THE STUDY OF WEATHER PHENOMENA.\*

By Rev. D. C. BATES, F.R.G.S., F.R.Met.Soc.

*(Continued from p. 177.)*

The *Temperature* of the air is the first subject we must deal with, and this in its most elementary form is as the senses perceive it. Heat is hard enough to define and explain, but even the most heedless youngster—the boy who on a wintry day neglects his overcoat, or the girl who forgets to put on her warm woollen undergarments—can usually tell you with some degree of definiteness the state of the air with regard to temperature and associate changes with times and events. In making a brief record first on the board, which one or more of the pupils may copy into a book, the teacher will draw out all sorts of information bearing on the subject. Every child will brighten up with associations and contradictions which the teacher will have to explain, guide or rule out of order. But to get them to understand, observe, remember and classify temperatures is the primary object in view.

*Wind Directions and Velocities* must have next attention. Fix the points of the compass roughly by the sun at sunrise, noon or sunset, and, from the usual point of observation, fix upon distant objects or the direction of a road for the points of reference on days when the sun is behind the clouds. Then the winds may be tabulated according to the four cardinal points and the four others half-way between, thus:—N, N.E., E., S.E., S., S.W., W., N.W., are all we need. For *velocity*, take the definitions used in our daily Weather Reports,† or use figures 0 for calm and 1 to 7 for the strength of the wind.

- |     |    |                                                                   |
|-----|----|-------------------------------------------------------------------|
| L.  | 1. | Light, just moving leaves on the trees.                           |
| B.  | 2. | Breeze moving branches.                                           |
| FB. | 3. | Fresh breeze, swaying branches, blowing up dust.                  |
| MG. | 4. | Moderate gale, blowing up twigs from ground, swaying whole trees. |
| G.  | 5. | Gale, breaking small branches, loosening bricks or chimneys.      |
| W.  | 6. | Gale of exceptional force, doing tremendous damage.               |

*Cloudiness* may be studied in three ways:—(1) For amount of the sky covered at a definite time, which is usually 9 a.m., in tenths. 0 is a clear day, and 1 with a little cloud, 2 more, 5 half covered, and so on to 10, quite overcast. (2) A simpler notation dependent on the scale of tenths for the estimation of the cloudiness or weather is the use of four letters to describe it at a certain time, or even for a whole day, as:—

\* A paper read to a gathering of teachers at the Training College, Wellington, N.Z., August 1st, 1907.

† The Weather Reports of New Zealand are referred to. In the British Isles every alternate value of the Beaufort scale might conveniently be used.—ED. *S.M.M.*

- B. For blue, less than  $\frac{2}{10}$  cloudy.
- F. For fair, from  $\frac{2}{10}$  to  $\frac{7}{10}$  cloudy.
- C. For cloudy, over  $\frac{7}{10}$  cloudy ; and
- R. For rain, when the sky is usually overcast.

(3) By a description of the clouds according to their main divisions :— The stratus, or level low-lying clouds ; the cumulus, or heaped or humpy clouds ; and the cirrus, or lofty, feathery clouds, built up of delicate threads of particles of ice. Changes from one type to another are most instructive, and each has its own story to tell. The cirrus often heralds wind and storm ; the stratus of winter thickens for rain, and the cumulus gathers up after the storm or before the thunderstorm or southerly that clears the air.

These are infant studies ; but we may proceed to further division and classification as the studies advance. The international classification may be used as in all observatories, or we may exercise a little freedom and make our own independent studies in the form, colour, height, changes, direction of movement, and difference of direction between upper and lower clouds. At all times associate your observations with the weather that has passed here but is probably still prevailing at a distance, and with the weather which the clouds tell you to expect in the near future. Science is organised with accurate knowledge ; therefore, work in the main upon the same lines as others, by using, as far as possible, the same terms. Tabulation, association and speculation will then show you that similar results follow similar causes. From these we form for ourselves empirical rules concerning the relationships between the clouds and the weather. The best local forecasters, especially of rain and wind, often go by nothing else than the clouds and their movements. Fishermen, shepherds and others who only use the tables of their memories, often attain, by steps and methods they cannot even trace, wonderful accuracy in the forecast of weather. Scientific methods are surer and safer, and those who will take the trouble carefully to observe, note down, tabulate and associate the various changes will obtain valuable results, but patience and perseverance are needed.

*Hyther* is a brand new word coined by Mr. W. F. Tyler, who lives at Shanghai where the heat and moisture at times makes life most uncomfortable. He invented it to express the degree of comfort, or rather discomfort, caused by weather. A bare record of temperature does not give the fullest idea of climatic effects. Dry heat, as in Australia, is tolerable ; dry cold is enjoyable, as in the Canadian winter ; cold moisture gives raw weather, hot moisture gives muggy weather, and this combination of the two is the hardest to bear. Mr. Tyler takes 0 as a perfect day, and 10 as almost unbearable, and by the numbers between he estimates varying degrees of discomfort. Professor Dexter, of America, in his book on "Weather Influences," treated of the effect especially upon school children, endeavouring to

show the times when school children were careless, unruly, etc., in relation to weather. Now take temperature, humidity, cloudiness (that makes us sad), *sunshine* that makes the butterflies come out and the youngster play truant; wind (that makes our horses frisky and unruly), and lump these phases together and estimate our days 1, 2, 3, 4, 5, 6, let us hope none of you ever get beyond that as an estimate of the sum total of the collective of bad sensations, as the effect of the weather on the body and mind. I think it would make an interesting addition to our registers especially as we shall see later we can somewhat check the records by instrumental tests with the hygrometer.

A full juvenile or first grade record would include:—

| DATE. | TEMP. | WIND. |           | CLOUD.         |       |                            | REMARKS. | HYTHRR. |
|-------|-------|-------|-----------|----------------|-------|----------------------------|----------|---------|
|       |       | Dir.  | Velocity. | Amount<br>0—10 | Kind. | Movement.<br>Lower. Upper. |          |         |

The teacher could draw out the record and write it upon the board and then one of the pupils, the honorary clerk of the weather, make a record in a book using both sides of the note book, or, better still, let all the pupils copy it out and on Monday morning summarise the last week and write the story of the weather as briefly, accurately and comprehensively as possible. At the end of the month the whole could be summarised and shown statistically, graphically by diagram, or even by picture. Such work gives a simple grip of most valuable methods and is extremely valuable as a school exercise. But, though it is hardly necessary to say so, it must not all be attempted at once or weather observations would be very burdensome.

Every place has a different climate owing to many complex influences of different soils, aspects for sunshine, neighbouring woods or hills, exposure to prevailing winds, etc. The climate depends a great deal upon the conformation of the country, and great mistakes are often made for want of a little weather knowledge some people would call common sense. I know of costly hospitals, asylums, mansions, etc., in different countries built in places naturally disagreeable both to plant and animal life. Primitive people understood weather signs. The Maori of old times usually built his *whare* on the sunny side of a hill, in a situation both airy and dry, and it was sheltered from the cold blasts by the palisading of the *pa*. In ignorance our settlers have often ruthlessly destroyed trees that would have given much comfort around their homesteads, sometimes they never realise their loss of comfort, but, if they do, how long a time they have to wait for natural shelter to grow again.

Correlation of the different elements of weather bring most useful but neglected facts home to the mind. For example we may take wind and temperature and record them in this form:—

|            | N. | N.E. | E. | S.E. | S. | S.W. | W. | N.W. | Total. | Percentage |
|------------|----|------|----|------|----|------|----|------|--------|------------|
| Very hot   |    |      |    |      |    |      |    |      |        |            |
| Hot .....  |    |      |    |      |    |      |    |      |        |            |
| Warm ...   |    |      |    |      |    |      |    |      |        |            |
| Cold ..... |    |      |    |      |    |      |    |      |        |            |
| Very cold  |    |      |    |      |    |      |    |      |        |            |

Or we may correlate wind and sky weather thus :—

|       | N. | N.E. | E. | S.E. | S. | S.W. | W. | N.W. | Total. | Percentage |
|-------|----|------|----|------|----|------|----|------|--------|------------|
| B.    |    |      |    |      |    |      |    |      |        |            |
| F.    |    |      |    |      |    |      |    |      |        |            |
| O.    |    |      |    |      |    |      |    |      |        |            |
| R.    |    |      |    |      |    |      |    |      |        |            |
| Total |    |      |    |      |    |      |    |      |        |            |
| %     |    |      |    |      |    |      |    |      |        |            |

The teacher will then be in a position to explain how the winds take their characteristics from the regions they come from. Cold from the south, hot from the north.\*

Squared paper and cross lined exercise books can be used for diagrams to show varying forces of wind, cloudiness, direction of wind, Hyther, etc.

There are many other directions in which the study of weather phenomena without instruments might profitably be pursued, but we must hasten to speak of meteorological instruments which should only aid, though they sometimes seem to supersede real thought. People are apt to be satisfied with mere statistics which may be quite misleading, and it is to be regretted that English meteorologists the world over have had to pursue such drudgery in producing figures that their brains have but little chance of occupation in drawing out the meanings by a proper use of statistics. Brain work for research and not machine work for the printer is most needed. Bearing this in mind we may regard meteorological instrumental results as an *aid* but never as the supreme end in meteorological work. They are simply invaluable—essential indeed to the advance of the science, but meteorological research must be much more than a mere compilation of statistics. Do not let your work stop at that dead level, but rather study and observe until you feel an earnest desire to take up some special line of study in weather phenomena.

My present object is not to deliver a popular lecture upon the

\* Again we remind our readers that the author addresses teachers in the southern hemisphere.—ED. *S.M.M.*



science, or to give instruction in meteorology itself, but to direct you to methods of independent study and for the teaching of the subject in two grades—(1.) Preliminary, without the aid of instruments; and (2.) Elementary Studies, with the aid of instruments. Advanced meteorology with its most interesting relationships to other sciences and dependence upon them for solution of its fascinating problems hardly comes within our scope, but I trust some of you will in time pursue it.

The best method of teaching meteorology to the little ones is the old one of catechetical enquiry, leading them by degrees to independent recognition of definite facts, and the discovery of relationships which exist between weather phenomena and definite causes. This can never be done all in one lesson, one season, or one year. You must hasten slowly, and carefully lay the foundations, not too much of the same thing, lest the pupils become weary, and not so much variety that the way is lost. By varying the observations interest may be awakened and sustained through a course of simple studies up to a more complete and advanced knowledge,—in a word the lessons must have a living interest, and be progressively instructive.

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## METEOROLOGICAL NEWS AND NOTES.

THE SYMONS GOLD MEDAL for 1908 was awarded by the council of the Royal Meteorological Society, at their meeting on October 16th, to Monsieur L. Teisserenc de Bort, of Paris, in recognition of the services which he has rendered to the science of meteorology. The medal was established in memory of the late George James Symons, F.R.S., the founder of the British Rainfall Organization, and is awarded biennially. The presentation will take place at the annual general meeting of the society on January 15th.

AT THE METEOROLOGICAL OFFICE the Director resumed on October 28th the series of meetings commenced in 1905 for the informal discussion of important contributions to Meteorological Literature, particularly those by Colonial or Foreign Meteorologists. The days provisionally arranged for the meetings are the following Mondays (at 5 p.m.):—November 25th, December 9th, 1907; January 20th, February 3rd and 17th, March 2nd, 16th, and 30th, 1908. The Director will be glad if contributors of observations to the Office, and others interested in Meteorology, will favour him with their presence at 63, Victoria Street, S.W., and take part in the discussions.

DR. W. N. SHAW, F.R.S., Reader in Meteorology in the University of London, commenced a series of twelve lectures on Meteorological Organization and Methods of dealing with meteorological observations, on Monday, October 21st, and these are being con-

tinued on alternate Mondays, at the University of London, South Kensington. The lectures are designed for advanced students at the University and others interested in Meteorology. There is no fee for the course.

THE INTERNATIONAL METEOROLOGICAL COMMITTEE met at Paris on September 10th, ten out of the seventeen members being present. Dr. Shaw was appointed President in succession to M. Mascart, and Prof. Hellmann was appointed Secretary, in succession to Prof. Hildebrandsson. From a very brief report in *Nature* we learn that the principal subjects discussed were the scheme of organisation of international meetings for meteorological purposes; marine charts and weather signals; a number of items of the international daily weather service, including reports by wireless telegraphy; and various propositions concerning the meteorology of the globe, in which were included one on the necessity for observing stations in the regions of centres of action of the atmosphere, another on the necessity for new charts of isotherms for the globe, and a third on the desirability of daily observations from selected stations, in order to trace the course of meteorological changes over the globe.

DR. W. DOBERCK, the late Director of the Observatory at Hong Kong has been succeeded in that position by Mr. F. G. Figg, who has been connected with the Observatory for many years.

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### WEATHER WHIMS A HUNDRED YEARS AGO.

AMONGST the interesting extracts from *The Times* of a century ago, we note the following quaint paragraph from the issue of Friday, October 30th, 1807:—

“A man at *Thorn* has announced a discovery made by him, of a *certain* method, by which he can procure a constancy of ‘settled pleasant, healthy, and fruitful weather;’ and he adds, that he hopes ‘the Great Nation will attend to it.’ This undoubtedly deserves attention. Such an experiment is certainly beyond that of Dr. Franklin and others, who made *lightning* by poking at the clouds; or those of a late writer, who proposes enormous *mills* and *machines* in this Country, ‘only to *abate* the rigour of the seasons,’ by the effect of their friction on the atmosphere; or that of Jacques Bernardin St. Pierre, who suggests the erection of *pyramids*, losing themselves in the skies, in countries where there are no mountains, to attract vapour, create clouds, and make showers of rain descend upon the plains beneath. It is suggested that we might as well buy up the secret, as let France get it, for we want it, both *at home* and in our *colonies*. ’Tis, however, rather an awkward circumstance for this sagacious Citizen, that he did not discover his *secret* while Napoleon was struggling, in his neighbourhood, with all the rigours of a *winter* climate, in his campaign against the Russians.”

## TEMPERATURE FOR OCTOBER, 1907.

| STATION.                           | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |         |      |        | No. of<br>atmos.<br>be.<br>w. |
|------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|---------|------|--------|-------------------------------|
|                                    |                      |            |                      |                                | Max.         |         | Min. |        |                               |
|                                    |                      |            |                      |                                | °            | Date.   | °    | Date.  |                               |
| Camden Square.....                 | London.....          | 51 32      | 0 8                  | 111                            | 68.2         | 1       | 37.1 | 24.26  | 0                             |
| Tenterden.....                     | Kent.....            | 51 4       | 0 41                 | 190                            | 66.0         | 1       | 31.0 | 25     | 1                             |
| West Dean.....                     | Hampshire.....       | 51 3       | 1 38                 | 137                            | 63.0         | 1, 6    | 30.0 | 27     | 5                             |
| Hartley Wintney.....               | ".....               | 51 18      | 0 53                 | 222                            | 65.0         | 1, 2, 3 | 30.0 | 25     | 2                             |
| Hitchin.....                       | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | 65.0         | 1       | 30.0 | 24     | 3                             |
| Winslow (Addington).....           | Buckinghamsh. ....   | 51 58      | 0 53                 | 309                            | 65.0         | 1       | 32.0 | 16, 24 | 2                             |
| Bury St. Edmunds (Westley).....    | Suffolk.....         | 52 15      | 0 40                 | 226                            | 66.0         | 1       | 31.0 | 24     | 1                             |
| Brundall.....                      | Norfolk.....         | 52 37      | * 1 26               | 66                             | 65.4         | 1       | 33.6 | 25     | 0                             |
| Winterbourne Steepleton.....       | Dorset.....          | 50 42      | 2 31                 | 316                            | 62.0         | 1       | 30.2 | 25     | 1                             |
| Torquay (Cary Green).....          | Devon.....           | 50 28      | 3 32                 | 12                             | 65.9         | 4       | 38.8 | 27     | 0                             |
| Polapit Tamar [Launceston].....    | ".....               | 50 40      | 4 22                 | 315                            | 61.5         | 4       | 31.8 | 16     | 1                             |
| Bath.....                          | Somerset.....        | 51 23      | 2 21                 | 67                             | 64.5         | 1       | 32.0 | 25     | 1                             |
| Stroud (Upfield).....              | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 65.0         | 1       | 38.0 | 24, 31 | 0                             |
| Church Stretton (Wolaston).....    | Shropshire.....      | 52 35      | 2 48                 | 800                            | 64.0         | 7       | ...  | ...    | ...                           |
| Coventry (Kingswood).....          | Warwickshire.....    | 52 24      | 1 30                 | 340                            | 60.0         | 1       | 34.0 | 16     | 0                             |
| Boston.....                        | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 65.0         | 1       | 32.0 | 24     | 1                             |
| Worksop (Hodsock Priory).....      | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 66.1         | 6       | 29.2 | 8      | 4                             |
| Derby (Midland Railway).....       | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 66.0         | 1       | 31.0 | 15     | 4                             |
| Bolton (Queen's Park).....         | Lancashire.....      | 53 35      | 2 28                 | 390                            | 63.8         | 1       | 33.3 | 16     | 0                             |
| Wetherby (Ribston Hall).....       | Yorkshire, W.R. .... | 53 59      | 1 24                 | 130                            | ...          | ...     | ...  | ...    | ...                           |
| Arncliffe Vicarage.....            | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...     | ...  | ...    | ...                           |
| Hull (Pearson Park).....           | "..... E.R.          | 53 45      | 0 20                 | 6                              | 67.0         | 6       | 32.0 | 8      | 1                             |
| Newcastle (Town Moor).....         | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...     | ...  | ...    | ...                           |
| Borrowdale (Seathwaite).....       | Cumberland.....      | 54 30      | 3 10                 | 423                            | 61.6         | 6       | 33.8 | 29     | 0                             |
| Cardiff (Ely).....                 | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...     | ...  | ...    | ...                           |
| Haverfordwest (High Street).....   | Pembroke.....        | 51 48      | 4 58                 | 95                             | 60.2         | 6       | 33.0 | 24     | 0                             |
| Aberystwyth (Gogerddan).....       | Cardigan.....        | 52 26      | 4 1                  | 83                             | 70.0         | 1       | 27.0 | 15     | ...                           |
| Llandudno.....                     | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 68.0         | 2       | 37.0 | 14     | 0                             |
| Cargen (Dumfries).....             | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 62.0         | 4       | 31.0 | 27     | 1                             |
| Lilliesleaf (Riddell House).....   | Roxburgh.....        | 55 31      | 2 46                 | 550                            | ...          | ...     | ...  | ...    | ...                           |
| Edinburgh (Royal Observatory)..... | Midlothian.....      | 55 55      | 3 11                 | 442                            | 61.2         | 5       | 34.8 | 16     | 0                             |
| Girvan (Pinnore).....              | Ayr.....             | 55 10      | 4 49                 | 207                            | 61.0         | 9       | 27.0 | 27     | 3                             |
| Glasgow (Queen's Park).....        | Renfrew.....         | 55 53      | 4 18                 | 144                            | 60.0         | 1       | 32.0 | 26     | 1                             |
| Tighnabruach.....                  | Argyll.....          | 55 55      | 5 14                 | 50                             | 56.0         | 1, 2    | 32.0 | 16, 26 | 2                             |
| Mull (Quinish).....                | ".....               | 56 36      | 6 13                 | 35                             | 61.0         | 5       | ...  | ...    | ...                           |
| Dundee (Eastern Necropolis).....   | Forfar.....          | 56 28      | 2 57                 | 199                            | 59.2         | 6       | 31.2 | 9      | 1                             |
| Braemar.....                       | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...     | ...  | ...    | ...                           |
| Aberdeen (Cranford).....           | ".....               | 57 8       | 2 7                  | 120                            | 64.0         | 9       | 30.0 | 24     | 2                             |
| Cawdor.....                        | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...     | ...  | ...    | ...                           |
| Invergarry.....                    | E. Inverness.....    | 57 4       | 4 47                 | 130?                           | ...          | ...     | ...  | ...    | ...                           |
| Loch Torridon (Bendamph).....      | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...     | ...  | ...    | ...                           |
| Dunrobin Castle.....               | Sutherland.....      | 57 59      | 3 56                 | 14                             | 58.0         | 2       | 32.0 | 8      | 1                             |
| Castletown.....                    | Caithness.....       | 58 35      | 3 23                 | 100                            | 62.0         | 5       | 26.0 | 7      | 4                             |
| Killarney (District Asylum).....   | Kerry.....           | 52 4       | 9 31                 | 178                            | 65.0         | 2       | 31.0 | 16     | ...                           |
| Waterford (Brook Lodge).....       | Waterford.....       | 52 15      | 7 7                  | 104                            | 62.0         | 4       | 28.0 | 16     | 3                             |
| Broadford (Hurdlestown).....       | Clare.....           | 52 48      | 8 38                 | 167                            | 60.0         | 5, 6    | 30.0 | 15, 23 | 2                             |
| Abbey Leix (Blandsfort).....       | Queen's County.....  | 52 56      | 7 17                 | 532                            | 62.0         | 5, 6    | ...  | ...    | ...                           |
| Dublin (Fitz William Square).....  | Dublin.....          | 53 21      | 6 14                 | 54                             | 65.1         | 5       | 32.8 | 24     | 0                             |
| Ballinasloe.....                   | Galway.....          | 53 20      | 8 15                 | 160                            | 66.0         | 20      | 29.0 | 27     | 5                             |
| Clifden (Kylmore House).....       | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...     | ...  | ...    | ...                           |
| Crossmolina (Ennisceoe).....       | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...     | ...  | ...    | ...                           |
| Seaforde.....                      | Down.....            | 54 19      | 5 50                 | 180                            | 64.0         | 5       | 30.0 | 15     | 2                             |
| Londonderry (Creggan Res.).....    | Londonderry.....     | 54 59      | 7 19                 | 320                            | ...          | ...     | ...  | ...    | ...                           |
| Omagh (Edenfel).....               | Tyrone.....          | 54 36      | 7 18                 | 280                            | ...          | ...     | ...  | ...    | ...                           |

## RAINFALL FOR OCTOBER, 1907.

| RAINFALL OF MONTH. |              |                             |                |                      |       |                   | RAINFALL FROM JAN. 1.    |              |                               |                | Mean Annual 1870-1899. | STATION.           |
|--------------------|--------------|-----------------------------|----------------|----------------------|-------|-------------------|--------------------------|--------------|-------------------------------|----------------|------------------------|--------------------|
| r.<br>-99.         | 1907.<br>in. | Diff.<br>from<br>Av.<br>in. | %<br>of<br>Av. | Max. in<br>24 hours. |       | No.<br>of<br>Days | Aver.<br>1870-99.<br>in. | 1907.<br>in. | Diff.<br>from<br>Aver.<br>in. | %<br>of<br>Av. |                        |                    |
|                    |              |                             |                | in.                  | Date. |                   |                          |              |                               |                | in.                    |                    |
| 5                  | 2.52         | - .33                       | 88             | .34                  | 5     | 22                | 20.59                    | 17.08        | - 3.51                        | 83             | 25.16                  | Camden Square      |
| 10                 | 5.73         | +2.13                       | 159            | .79                  | 3     | 25                | 22.40                    | 19.44        | - 2.96                        | 87             | 28.36                  | Tenterden          |
| 13                 | 7.76         | +4.23                       | 215            | 1.13                 | 10    | 25                | 23.94                    | 22.21        | - 1.73                        | 93             | 29.93                  | West Dean          |
| 18                 | 5.35         | +2.27                       | 174            | .95                  | 14    | 24                | 21.52                    | 21.55        | +                             | 103            | 27.10                  | Hartley Wintney    |
| 2                  | 3.70         | + .98                       | 136            | 1.38                 | 14    | 19                | 20.05                    | 18.98        | - 1.07                        | 95             | 24.66                  | Hitchin            |
| 19                 | 3.94         | +1.05                       | 127            | .76                  | 16    | 20                | 21.85                    | 19.68        | - 2.17                        | 90             | 26.75                  | Addington          |
| 16                 | 2.58         | - .08                       | 87             | .42                  | 14    | 16                | 20.78                    | 19.34        | - 1.44                        | 93             | 25.39                  | Westley            |
| 18                 | 3.90         | + .92                       | 131            | .86                  | 9     | 24                | 20.56                    | 20.33        | - 2.3                         | 99             | 25.40                  | Brundall           |
| 13                 | 10.12        | +5.79                       | 259            | 1.39                 | 16    | 26                | 30.05                    | 29.02        | - 1.03                        | 97             | 39.00                  | Winterbourne Stptn |
| 19                 | 7.92         | +3.83                       | 193            | 1.91                 | 16    | 27                | 27.83                    | 24.76        | - 3.07                        | 89             | 35.00                  | Torquay            |
| 17                 | 7.96         | +2.99                       | 160            | 1.26                 | 16    | 28                | 30.17                    | 28.16        | - 2.01                        | 93             | 38.85                  | Polapit Tamar      |
| 22                 | 5.67         | +2.45                       | 176            | .75                  | 10    | 26                | 24.93                    | 25.30        | +                             | 101            | 30.75                  | Bath               |
| 10                 | 5.94         | +2.84                       | 191            | 1.15                 | 16    | 24                | 24.38                    | 24.45        | + .07                         | 100            | 29.85                  | Stroud             |
| 19                 | 7.07         | +3.08                       | 177            | 1.68                 | 16    | 24                | 26.94                    | 29.05        | + 2.11                        | 108            | 33.04                  | Wolstaston         |
| 18                 | 5.03         | +1.85                       | 158            | 1.31                 | 16    | 21                | 23.97                    | 23.46        | - .51                         | 98             | 29.21                  | Coventry           |
| 52                 | 4.09         | +1.47                       | 156            | 1.04                 | 6     | 21                | 19.37                    | 17.83        | - 1.54                        | 92             | 23.30                  | Boston             |
| 77                 | 5.35         | +2.58                       | 193            | 2.05                 | 16    | 21                | 20.58                    | 19.38        | - 1.20                        | 94             | 24.70                  | Hodsock Priory     |
| 77                 | 3.79         | +1.02                       | 137            | .96                  | 16    | 24                | 21.62                    | 23.70        | + 2.08                        | 109            | 26.18                  | Derby              |
| 72                 | 4.03         | - .69                       | 85             | .55                  | 12    | 23                | 34.33                    | 37.40        | + 3.07                        | 109            | 42.43                  | Bolton             |
| 18                 | 6.09         | +2.91                       | 191            | 1.01                 | 16    | 23                | 22.54                    | 23.48        | + .94                         | 104            | 26.96                  | Ribston Hall       |
| 55                 | 7.02         | + .47                       | 107            | 1.09                 | 16    | 22                | 48.55                    | 49.67        | + 1.12                        | 103            | 60.96                  | Arncliffe Vic.     |
| 26                 | 3.96         | + .70                       | 121            | .87                  | 16    | 22                | 22.21                    | 19.98        | - 2.23                        | 90             | 27.02                  | Hull               |
| 94                 | 5.86         | +2.92                       | 199            | .86                  | 25    | 26                | 22.70                    | 22.50        | - .20                         | 99             | 27.99                  | Newcastle          |
| 35                 | 15.11        | +1.76                       | 113            | 2.73                 | 12    | 26                | 104.07                   | 98.25        | - 5.82                        | 94             | 132.68                 | Seathwaite         |
| 81                 | 7.33         | +2.52                       | 153            | .88                  | 8     | 30                | 34.12                    | 31.49        | - 2.63                        | 92             | 42.81                  | Cardiff            |
| 63                 | 8.80         | +3.17                       | 156            | .89                  | 30    | 31                | 37.25                    | 35.68        | - 1.57                        | 96             | 47.88                  | Haverfordwest      |
| 58                 | 6.56         | + .98                       | 118            | 1.13                 | 21    | 24                | 36.24                    | 38.06        | + 1.82                        | 105            | 45.41                  | Gogerddan          |
| 08                 | 5.28         | +1.20                       | 130            | .59                  | 30    | 25                | 24.65                    | 21.71        | - 2.94                        | 88             | 30.98                  | Llandudno          |
| 39                 | 8.59         | +4.20                       | 196            | 1.04                 | 14    | 20                | 34.25                    | 39.95        | + 5.70                        | 117            | 43.43                  | Cargen             |
| 24                 | ...          | ...                         | ...            | ...                  | ...   | ...               | 26.57                    | ...          | ...                           | ...            | 33.04                  | Riddell House      |
| ..                 | 7.90         | ...                         | ...            | 3.13                 | 15    | 25                | ...                      | 25.36        | ...                           | ...            | ...                    | Edinburgh          |
| 42                 | 8.49         | +3.07                       | 157            | 2.10                 | 15    | 25                | 38.32                    | ...          | ...                           | ...            | 48.87                  | Girvan             |
| 36                 | 6.66         | +3.30                       | 200            | 2.27                 | 15    | 26                | 28.79                    | 34.34        | + 5.55                        | 119            | 35.80                  | Glasgow            |
| 72                 | 7.31         | +1.59                       | 128            | 1.90                 | 15    | 22                | 45.36                    | 51.10        | + 5.74                        | 113            | 57.90                  | Tighnabruach       |
| 09                 | 3.80         | -2.29                       | 62             | .50                  | 9     | 19                | 44.62                    | 41.34        | - 3.28                        | 92             | 57.53                  | Quinish            |
| 71                 | 5.20         | +2.49                       | 191            | 1.55                 | 15    | 21                | 23.46                    | 26.45        | + 2.99                        | 113            | 28.95                  | Dundee             |
| 05                 | 4.06         | + .01                       | 100            | ...                  | ...   | ...               | 28.98                    | 25.82        | - 3.16                        | 89             | 36.07                  | Braemar            |
| 18                 | 6.01         | +2.83                       | 189            | 1.47                 | 17    | 21                | 26.15                    | 26.61        | + .46                         | 102            | 33.01                  | Aberdeen           |
| 85                 | 5.04         | +2.19                       | 177            | 1.46                 | 15    | 12                | 24.19                    | 27.13        | + 2.94                        | 112            | 29.37                  | Cawdor             |
| 54                 | 3.21         | -2.33                       | 58             | .85                  | 16    | 14                | 43.35                    | 46.34        | + 2.99                        | 107            | 56.00                  | Invergarry         |
| 98                 | 3.46         | -6.62                       | 35             | .49                  | 14    | 18                | 67.67                    | 72.44        | + 4.77                        | 109            | 86.50                  | Bendauph           |
| 32                 | 2.01         | -1.31                       | 60             | .35                  | 9     | 14                | 24.95                    | 26.86        | + 1.91                        | 108            | 31.60                  | Dunrobin Castle    |
| ...                | 2.98         | ...                         | ...            | .87                  | 15    | 25                | ...                      | 26.09        | ...                           | ...            | ...                    | Castletown         |
| 05                 | 7.04         | + .99                       | 116            | .71                  | 1     | 30                | 45.62                    | 34.45        | -11.17                        | 75             | 58.11                  | Killarney          |
| 00                 | 6.12         | +2.12                       | 153            | .85                  | 27    | 27                | 31.08                    | 29.13        | - 1.95                        | 94             | 39.30                  | Waterford          |
| 12                 | 4.87         | +1.75                       | 156            | .79                  | 2     | 27                | 26.91                    | 28.71        | + 1.80                        | 107            | 33.47                  | Hurdlestown        |
| 45                 | 5.89         | +2.44                       | 171            | 1.00                 | 8     | 29                | 28.50                    | 30.13        | + 1.63                        | 106            | 35.19                  | Abbey Leix         |
| 08                 | 5.12         | +2.04                       | 166            | .71                  | 8     | 29                | 22.76                    | 22.25        | - .51                         | 98             | 27.75                  | Dublin             |
| 45                 | 4.31         | + .86                       | 125            | .80                  | 9     | 25                | 29.81                    | 29.41        | - .40                         | 99             | 37.04                  | Ballinasloe        |
| 93                 | 11.26        | +3.33                       | 142            | 1.90                 | 1     | 27                | 62.99                    | 58.03        | - 4.96                        | 92             | 80.23                  | Kylemore House     |
| 04                 | 6.60         | +1.56                       | 131            | .85                  | 18    | 29                | 39.06                    | 40.74        | + 1.68                        | 104            | 50.50                  | Ennisceoe          |
| 82                 | 5.55         | +1.73                       | 141            | .63                  | 20    | 23                | 31.03                    | 33.17        | + 2.14                        | 107            | 38.61                  | Seaford            |
| 45                 | 3.64         | - .81                       | 82             | .82                  | 6     | 24                | 32.70                    | 39.58        | + 6.88                        | 121            | 41.20                  | Londonderry        |
| 72                 | ...          | ...                         | ...            | ...                  | ...   | ...               | 30.55                    | ...          | ...                           | ...            | 37.85                  | Omagh              |

## SUPPLEMENTARY RAINFALL, OCTOBER, 1907.

| Div.  | STATION.                      | Rain<br>inches | Div.   | STATION.                    | Rain.<br>inches |
|-------|-------------------------------|----------------|--------|-----------------------------|-----------------|
| II.   | Abinger Hall .....            | 7.08           | XI.    | Rhayader, Tyrmynydd .....   | 5.80            |
| "     | Ramsgate .....                | 4.69           | "      | Lake Vyrnwy .....           | 8.30            |
| "     | Hailsham .....                | 6.49           | "      | Llangyhanfal, Plas Draw.... | 8.15            |
| "     | Crowborough, Uckfield Lodge   | 6.36           | "      | Criccieth, Talarvor.....    | 5.17            |
| "     | Totland Bay, Aston House..    | 7.07           | "      | Llanberis, Pen-y-pass ..... | 16.82           |
| "     | Emsworth, Redlands.....       | 6.82           | "      | Lligwy .....                | 7.45            |
| "     | Alton, Ashdell .....          | 6.72           | "      | Douglas, Woodville .....    | 7.10            |
| "     | Newbury, Welford Park ...     | 7.53           | XII.   | Stoneykirk, Ardwell House   | 6.54            |
| III.  | Harrow Weald, Hill House..    | 4.66           | "      | Dairy, The Old Garroch ...  | 10.08           |
| "     | Oxford, Magdalen College..    | 5.18           | "      | Langholm, Drove Road.....   | 7.34            |
| "     | Bloxham Grove .....           | 5.39           | "      | Moniaive, Maxwellton House  | 9.14            |
| "     | Pitaford, Sedgebrook.....     | 4.66           | XIII.  | N. Esk Reservoir [Penicuik] | 9.00            |
| "     | Huntingdon, Brampton .....    | 3.43           | XIV.   | Maybole, Knockdon Farm..    | 7.30            |
| "     | Wisbech, Bank House .....     | 2.78           | XV.    | Campbeltown, Witchburn...   | 6.21            |
| IV.   | Southend Water Works.....     | 3.05           | "      | Inveraray, Newtown .....    | 4.15            |
| "     | Colchester, Lexden .....      | 2.46           | "      | Ballachulish House.....     | 4.63            |
| "     | Newport, The Vicarage.....    | 2.48           | "      | Islay, Eallabus .....       | 5.00            |
| "     | Rendlesham .....              | 3.00           | XVI.   | Dollar Academy .....        | 7.10            |
| "     | Swaffham .....                | 3.07           | "      | Loch Leven Sluice .....     | 6.77            |
| "     | Blakeney .....                | 4.10           | "      | Balquhider, Stronvar .....  | 5.67            |
| V.    | Bishops Cannings .....        | 5.81           | "      | Perth, Pitcullen House..... | 4.79            |
| "     | Ashburton, Druid House .....  | 5.53           | "      | Coupar Angus Station .....  | 4.80            |
| "     | Okehampton, Oaklands.....     | 7.81           | "      | Blair Atholl .....          | 2.75            |
| "     | Hartland Abbey .....          | 5.71           | "      | Montrose, Sunnyside Asylum  | 4.99            |
| "     | Lynmouth, Rock House .....    | 5.92           | XVII.  | Alford, Lynturk Manse ..... | 5.58            |
| "     | Probus, Lamellyn .....        | 8.02           | "      | Keith Station .....         | 5.78            |
| "     | Wellington, The Avenue .....  | ...            | XVIII. | N. Uist, Lochmaddy .....    | 2.21            |
| "     | North Cadbury Rectory .....   | 5.81           | "      | Alvey Manse .....           | 3.52            |
| VI.   | Clifton, Pembroke Road .....  | 5.33           | "      | Loch Ness, Drumnadrochit.   | 3.67            |
| "     | Ross, The Graig .....         | 8.51           | "      | Glencarron Lodge .....      | 3.85            |
| "     | Shifnal, Hatton Grange .....  | 4.99           | "      | Fearn, Lower Pitkerrie..... | 2.23            |
| "     | Cheadle, The Heath House..    | ...            | XIX.   | Invershin .....             | 1.97            |
| "     | Blockley, Upton Wold .....    | 8.40           | "      | Altnaharra .....            | 1.62            |
| "     | Worcester, Boughton Park..    | 6.84           | "      | Bettyhill .....             | 2.09            |
| VII.  | Market Overton .....          | 5.60           | XX.    | Dunmanway, The Rectory..    | 6.43            |
| "     | Market Rasen .....            | 4.47           | "      | Cork .....                  | 5.07            |
| "     | Bawtry, Hesley Hall.....      | 4.55           | "      | Darrynane Abbey .....       | 6.74            |
| VIII. | Neston, Hinderton Lodge....   | 3.90           | "      | Glenam [Clonmel] .....      | 6.99            |
| "     | Southport, Hesket Park....    | 3.80           | "      | Ballinarry, Gurteen .....   | 4.87            |
| "     | Chatburn, Middlewood .....    | 4.49           | "      | Miltown Malbay.....         | 6.20            |
| "     | Cartmel, Flookburgh .....     | 7.13           | XXI.   | Gorey, Courtown House ..... | 6.24            |
| IX.   | Langsett Moor, Up. Midhope    | 7.73           | "      | Moynalty, Westland .....    | 5.74            |
| "     | Scarborough, Scalby .....     | 4.02           | "      | Athlone, Twyford .....      | 3.62            |
| "     | Ingleby Greenhow .....        | 4.87           | "      | Mullingar, Belvedere.....   | 4.86            |
| "     | Mickleton .....               | 4.90           | XXII.  | Woodlawn .....              | 5.10            |
| X.    | Bardon Mill, Beltingham ...   | 6.52           | "      | Westport, Murrisk Abbey..   | ...             |
| "     | Ewesley, Fallowlee .....      | 5.84           | "      | Collooney, Markree Obey..   | 5.08            |
| "     | Ilderton, Lilburn Cottage.... | 7.46           | "      | Mohill .....                | 4.24            |
| "     | Keawick, York Bank .....      | 3.06           | XXIII. | Enniskillen, Portora .....  | 4.07            |
| XI.   | Llanfrechfa Grange.....       | 6.93           | "      | Warrenpoint, Summer Hill.   | 4.71            |
| "     | Treherbert, Tyn-y-waun .....  | 10.98          | "      | Banbridge, Milltown .....   | 4.09            |
| "     | Carmarthen, The Friary.....   | 9.40           | "      | Belfast, Springfield .....  | 4.28            |
| "     | Castle Malgwyn [Lechryd]..    | 10.62          | "      | Bushmills, Dundarave .....  | 4.26            |
| "     | Plymlimon.....                | 11.40          | "      | Stewartstown, The Square..  | 3.87            |
| "     | Crickhowell, Ffordlas.....    | 10.10          | "      | Killybegs .....             | 6.49            |
| "     | New Radnor, Ednol .....       | 9.83           | "      | Horn Head .....             | 5.24            |

## METEOROLOGICAL NOTES ON OCTOBER, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; S for Hail; S for Snow.

**CAMDEN SQUARE.**—Frequent though seldom heavy R, together with a preponderance of cloud and gloom, and absence of sunshine. The mean temp. was 51°·7, or 1°·9 above the average, chiefly owing to the absence of low minima. Duration of sunshine 73·9 hours, and of R 52·8 hours.

**CROWBOROUGH.**—R 2·08 in. above the average of 36 years, the deficiency since January 1st being reduced to ·17 in. R fell on every day, establishing a record. There was a considerable deficiency of sunshine. Mean temp. 49°·8, or 0°·2 above the average. Sharp TS on 20th.

**NORTH CADBURY RECTORY.**—Persistently and continuously wet, but with absence of really large falls. The temp., wind and cloud were all about normal, with a marked absence of extremes.

**ROSS.**—The wettest October since 1818, forming a great contrast to September. The Wye was in flood on 31st.

**BOLTON.**—Mean temp. 48°·4, or 1°·5 above the average. Sunshine occurred on 20 days, the total being 34·6 hours, or 21·7 below the average. Fog, generally slight, occurred on many days. Short TS, with heavy R, on 22nd.

**SOUTHPORT.**—Low but steady bar., with exceptional prevalence of light easterly winds, and many rain days, the total fall, however, being ·07 in. less than the average. Mean temp. 49°·9 or 1°·0 above the average. Duration of sunshine 88 hours, or one hour below the average, and of R 74·0 hours. Mean amount of ozone less than half the average.

**LILBURN.**—Remarkable for excessive R. Harvest was very late, and operations were entirely stopped after 5th. Thousands of acres of corn were still standing at the close of the month.

**HAVERFORDWEST.**—Very wet and mild, with a heavy gale on 19th. Crops were damaged by the R, and much corn was still out at the end. Duration of sunshine 77·4 hours.

**DOUGLAS.**—Wet and stormy throughout. The R was exceeded in 1893 only during the last 34 years.

**INVERARAY.**—Beautiful weather through the greater part of the month.

**MULL.**—Fine on the whole and very mild, with wind from E. throughout. An abundant harvest was secured in good order early in the month.

**STRONVAE.**—With the exception of the last six days it was a most depressing and unfavourable month for agriculture generally.

**COUFAR ANGUS.**—The R was 74 per cent. above the average, and coming at the close of a late season, was the most disastrous on record, though the month closed with promise of better weather. The mean temp. was 47°·1, or 2°·3 above the average.

**ABERDEEN.**—Wet, with light southerly and westerly winds, and heavy, cloudy skies. Much of the crops was still lying out in the fields at the end.

**DRUMNADROGHIT.**—R ·03 in. above, and rain days one below, the average of 21 years. The weather was unusually destructive to crops.

**DUNMANWAY.**—Wet on the whole, but the R was chiefly at night, and many of the days were fine and bright. Heavy frosts on 14th, 15th and 16th.

**CORK.**—R 1·77 in. above the average, and mean temp. 3°·8 above the average.

**DAREYNANE.**—R 24 per cent. above the average: it was generally mild, but with a few cold days about the middle. Strong gale and extremely high tide on 18th.

**BALLINGARRY.**—Persistently wet. "Black rain" fell during the night of 8th as at Birt and elsewhere. The first destructive frost occurred on 16th.

**DUBLIN.**—One of the wettest months on record, having 29 rain days. The R was, however, persistent rather than heavy. Mean temp. 49°·9, or 0°·4 above the average. TS lasting three hours on 9th.

**BANBRIDGE.**—Very wet, the R being 1·09 in. above the average of 45 years. The harvest was good, but much will be lost as it could not be got in.

## Climatological Table for the British Empire, May, 1907.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain |                | Aver. |   |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|------------|----------------|-------|---|
|                                                                  | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.     | Days.          |       |   |
|                                                                  | Temp.     | Date. | Temp.    | Date. |          |      |               |           |                 |                   |            |                |       |   |
| London, Camden Square                                            | 82.3      | 12    | 35.9     | 20    | 63.5     | 45.6 | 45.8          | 61.0      | 74              | 124.2             | 25.8       | inches<br>1.74 | 17    | — |
| Malta ... ..                                                     | 80.6      | 14    | 51.0     | 2     | 70.9     | 59.9 | 56.6          | 75        | 139.6           | ...               | .00        | 0              | 3.9   | — |
| Lagos ... ..                                                     | 92.0      | 16    | 70.0     | 28    | 87.2     | 75.4 | 74.7          | 76        | 159.0           | 67.0              | 14.86      | 19             | 7.3   | — |
| Cape Town ... ..                                                 | 76.8      | 4     | 41.0     | 28    | 62.9     | 50.3 | 50.9          | 83        | ...             | ...               | 6.29       | 19             | 6.2   | — |
| Durban, Natal ... ..                                             | 87.3      | 25    | 41.1     | 28    | 75.4     | 56.3 | ...           | ...       | 138.3           | ...               | .73        | 12             | 3.6   | — |
| Johannesburg ... ..                                              | 69.0      | 14    | 25.3     | 28    | 62.4     | 44.2 | 41.1          | 72        | 134.1           | 24.1              | .19        | 3              | 2.9   | — |
| Mauritius ... ..                                                 | 81.8      | 8     | 55.0     | 19    | 77.6     | 65.4 | 64.0          | 77        | 145.9           | 46.5              | 4.71       | 13             | 5.9   | — |
| Calcutta... ..                                                   | 102.1     | 9     | 68.1     | 24    | 95.8     | 76.7 | 73.1          | 69        | 156.6           | 67.2              | 5.48       | 7              | 3.7   | — |
| Bombay ... ..                                                    | 93.2      | 31    | 76.9     | 11    | 91.2     | 79.9 | 74.3          | 71        | 136.2           | 71.0              | .00        | 0              | 1.6   | — |
| Madras ... ..                                                    | 109.0     | 21    | 76.3     | 1     | 102.1    | 80.8 | 72.7          | 64        | 146.3           | 72.6              | .00        | 0              | 2.3   | — |
| Kodaikanal ... ..                                                | 74.3      | 26    | 50.2     | 16    | 70.2     | 54.4 | 40.1          | 66        | 140.9           | 42.4              | 5.37       | 18             | 4.1   | — |
| Colombo, Ceylon ... ..                                           | 80.4      | 3, 4  | 73.5     | 5     | 88.1     | 78.3 | 75.7          | 80        | 156.0           | 70.8              | 5.47       | 22             | 6.1   | — |
| Hongkong ... ..                                                  | 86.8      | 17    | 67.4     | 3     | 80.6     | 73.0 | 70.4          | 82        | 147.5           | ...               | 11.23      | 14             | 7.7   | — |
| Melbourne ... ..                                                 | 73.8      | 18    | 39.8     | 30    | 63.9     | 46.8 | 47.2          | 76        | 124.0           | 30.7              | 1.66       | 6              | 5.3   | — |
| Adelaide ... ..                                                  | 80.7      | 16    | 41.3     | 1     | 67.7     | 49.2 | 48.6          | 72        | 136.6           | 35.9              | 2.40       | 11             | 4.7   | — |
| Coolgardie ... ..                                                | 86.5      | 4     | 36.0     | 21    | 68.5     | 46.2 | 40.4          | 56        | 146.0           | 30.2              | 1.23       | 8              | 2.6   | — |
| Sydney ... ..                                                    | 73.1      | 7     | 45.9     | 1     | 65.4     | 51.8 | 50.5          | 84        | 104.8           | 35.3              | 1.70       | 19             | 4.3   | — |
| Wellington ... ..                                                | 62.5      | 24    | 38.9     | 15    | 55.6     | 46.7 | 44.8          | 79        | 102.0           | 30.0              | 6.39       | 20             | 5.1   | — |
| Auckland ... ..                                                  | 69.0      | 8     | 41.0     | 21    | 61.2     | 49.9 | 47.7          | 76        | 122.0           | 37.0              | 3.97       | 16             | 5.6   | — |
| Jamaica, Negril Point.                                           | 88.1      | 2     | 67.6     | 9     | 86.0     | 71.4 | 72.3          | 77        | ...             | ...               | 5.33       | 19             | ...   | — |
| Trinidad ... ..                                                  | 94.0      | 24    | 68.0     | sevr  | 87.6     | 70.8 | 73.1          | 82        | 160.0           | 62.0              | 4.58       | 14             | ...   | — |
| Grenada ... ..                                                   | 87.4      | 2     | 70.8     | 19    | 84.2     | 74.3 | 69.1          | 73        | 146.0           | ...               | 4.44       | 15             | 5.3   | — |
| Toronto ... ..                                                   | 76.3      | 18    | 26.0     | 12    | ...      | ...  | ...           | ...       | ...             | ...               | 1.93       | 9              | 5.6   | — |
| Fredericton ... ..                                               | ...       | ...   | ...      | ...   | ...      | ...  | ...           | ...       | ...             | ...               | ...        | ...            | ...   | — |
| St. John's, N.B. ... ..                                          | 63.0      | 17    | 31.8     | 3     | ...      | ...  | ...           | ...       | ...             | ...               | 2.96       | 10             | 7.0   | — |
| Victoria, B.C. ... ..                                            | 76.7      | 30    | 35.0     | 1     | ...      | ...  | ...           | ...       | ...             | ...               | .33        | 3              | 3.6   | — |
| Dawson ... ..                                                    | 80.0      | 23    | 23.0     | 11    | ...      | ...  | ...           | ...       | ...             | ...               | 1.06       | 9              | 5.0   | — |

MALTA.—Adopted mean temp. of air 64°.8. Mean hourly velocity of wind 7.6 miles. Mean sunshine 10.8 hours per day.

LAGOS.—R on the 13th 6.62 in.

Johannesburg.—Bright sunshine 287.4 hours.

Mauritius.—Mean temp. of air 0°.5, dew point 1°.3, and relative humidity 2.1 per cent., below averages, and R .75 in. above average.

MADRAS.—R 4.07 in. below average. TSS on one day.

KODAIKANAL.—Bright sunshine 229 hours.

COLOMBO.—Mean temp. of air 82°.5 or 0°.1 above, of dew point 0°.4 above, and R 6.30 in. below, averages. Mean hourly velocity of wind 8.6 miles. TSS on 3 days.

HONGKONG.—Mean temp. of air 76°.2. Bright sunshine 164.0 hours. Mean hourly velocity of wind 13.9 miles.

Adelaide.—Mean temp. of air 0°.7 above, and R .35 in. below, averages.

Sydney.—Mean temp. of air 0°.2 above, and R 3.48 in. below, averages.

Wellington.—Mean temp. of air 1°.7 below, and R 1.73 in. above, averages. Bright sunshine 93.5 hours.

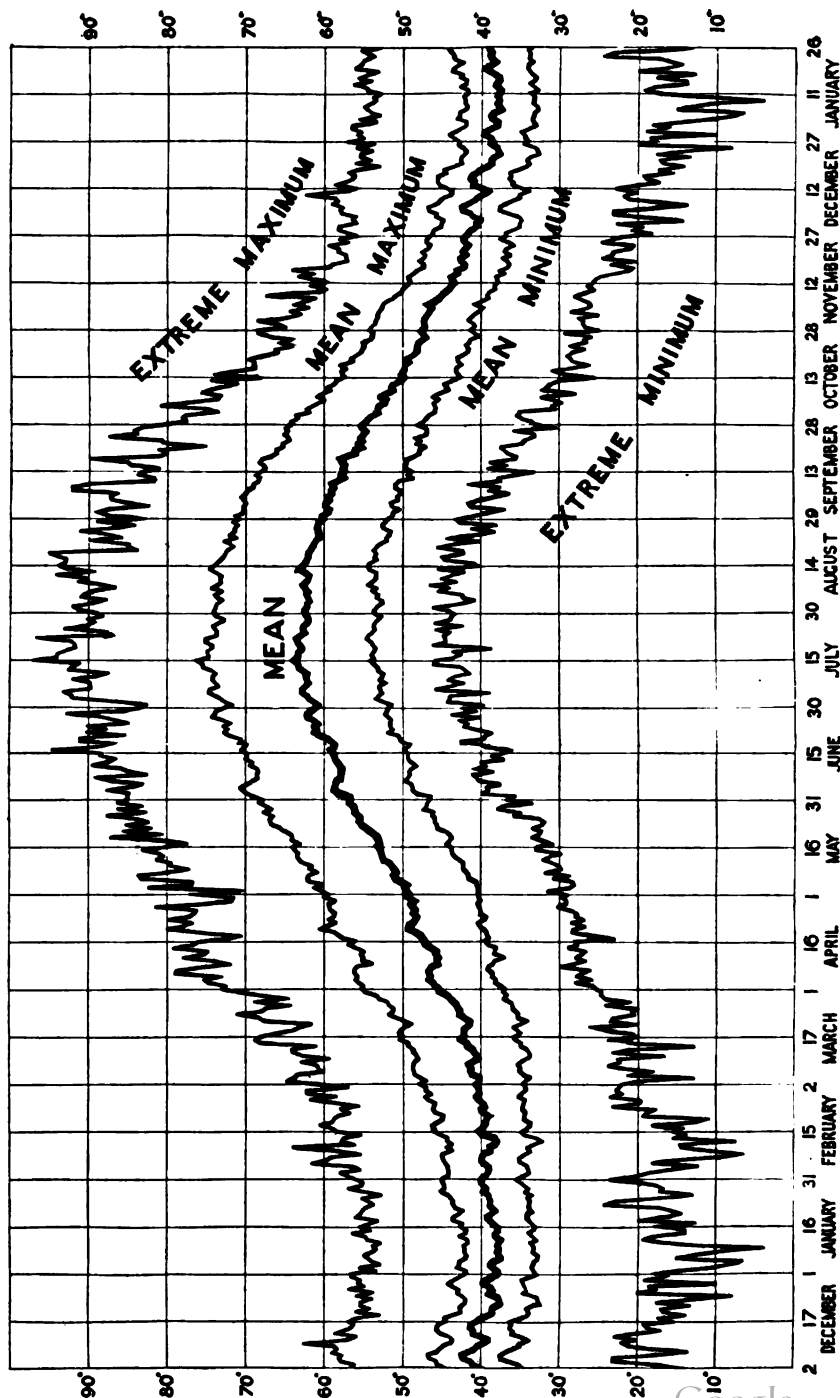
Auckland.—Mean temp. of air and R both slightly below averages of 40 years.

TRINIDAD.—Rainfall .88 in. above 43 years' average.





# TEMPERATURE — ROYAL OBSERVATORY GREENWICH . 65 YEARS 1841 — 1905 .



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## GREENWICH AIR TEMPERATURE.

By WILLIAM ELLIS, F.R.S.

THE recently published volume of results of Greenwich air temperature for the years 1891 to 1905\* is really supplementary to that which appeared in the year 1895 containing similar information for the previous fifty years 1841 to 1890,† thus forming, taken together, a continuous record of air temperature at Greenwich for the 65 years 1841 to 1905. Meteorological observations had always been taken at the Royal Observatory for astronomical purposes, and for many years previous to 1841 a daily meteorological register had been kept by members of the staff, but it was not until the establishment of the Magnetical and Meteorological Department of the Observatory in the latter part of the year 1840 that regular meteorological work was undertaken as part of the official duty. The observations previously for so many years taken at the apartments of the Royal Society at Somerset House were shortly afterwards discontinued.

The first four tables of the two volumes contain severally : (1) the mean temperature of the air ; (2) the daily maximum ; (3) the daily minimum, and (4) the daily range of temperature for every day throughout the sixty-five years, these being followed by twenty-nine abstract tables giving further information on special points, the results in the later publication being in every sense a direct continuation of those of the earlier volume, so giving every facility for the intercomparison thereof.‡ With the kind consent of the Astronomer Royal, Sir William Christie, I am able to add thereto a

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\* Reduction of Greenwich Meteorological Observations. Part IV. Temperature of the Air as determined from the Observations and Records of the fifteen years 1891 to 1905.

† Reduction of Greenwich Meteorological Observations. Part III. Temperature of the Air as determined from the Observations and Records of the fifty years 1841 to 1890.

‡ The continuation by Professor Wolfer of Zürich of the tabulation of the frequency of sunspots in the form originally arranged by his predecessor Dr. Wolf, may be noted as an instance of the value of respecting the traditions of an establishment whilst at the same time inaugurating also other advanced work.

reduced copy of the chart of temperature variations forming frontispiece to the second of the Greenwich volumes (an extension of a like chart appearing in the first volume), to which further reference will hereafter be made.

In Table I. we have in addition to the mean daily temperature of the air on every day of each of the 65 years, extremes and means of the daily values, and also means for each month in every year. It is sufficient here to say that from 1841 to 1847 the daily values depend on twelve two-hourly readings of the thermometer of the rotatory stand, except on Sundays when fewer observations were taken; in 1848 on six daily observations of the same thermometer, and from 1849 to 1905 on twenty-four hourly measures of the photographic record reduced to the reading of the thermometer of the rotatory stand, reverting in case of accidental photographic failure to the readings of that thermometer. The results thus depend either on observations in sufficient number of the thermometer of the rotatory stand or on photographic values reduced thereto. For a description of the rotatory stand reference may be made to the Introduction to the first of the two volumes, and for details concerning the treatment of the eye observations to the Introduction to either volume.

The daily maximum and daily minimum temperatures given in Tables II. and III. depend on the readings of the self-registering thermometers of the rotatory stand. From 1841 to 1847 these thermometers were read at 9.20 a.m. instead of at night, consequently the maximum temperature during this period was taken, in accordance with the usual practice of meteorologists, as applying to the preceding civil day. In Table IV. the daily range is the difference between the maximum and minimum readings of Tables II. and III., excepting that the apportionment of the maximum reading from 1841 to 1847 to the preceding day, in the manner mentioned, led on some occasions, in the irregular variations of winter, to an anomalous daily range, in which case a value was obtained by reference to the two-hourly eye observations of the particular day. Extreme and mean values are added in these tables as in Table I.

In Table V. we have the mean temperature of each day of the year (mean of 65 years) as collected from Table I. The lowest daily temperature of the year,  $37^{\circ}47$ , is reached on January 12, followed by a rise to  $40^{\circ}23$  on January 31. A further descent to  $38^{\circ}00$  occurs on February 12, after which the rise towards spring begins, receiving, however, a slight check in the last week of April. The highest daily temperature of the year,  $64^{\circ}01$ , is reached on July 15, followed by a fall to  $61^{\circ}78$  on August 3. A second rise to  $63^{\circ}12$  occurs on August 13, after which there is continuous fall to the minimum of winter. There are similar variations, Tables VIII. and X., in the corresponding values of mean maximum and mean minimum temperature.

Table XII. gives the mean daily temperature (65-year means)

found by taking the mean of the maximum and minimum temperatures indicated by the self-registering thermometers, and Table XIII. shows the difference on each day between this mean and the true mean temperature of Table V. The monthly means of these daily differences show the mean from the maximum and minimum in January to be too low by  $0^{\circ}22$ , in February too high by  $0^{\circ}23$ , and continuously too high in March by  $0^{\circ}61$ , in April by  $0^{\circ}81$ , in May by  $0^{\circ}77$ , in June by  $0^{\circ}89$ , in July by  $1^{\circ}07$ , in August by  $1^{\circ}24$ , in September by  $0^{\circ}96$ , and in October by  $0^{\circ}39$ ; in November the maximum and minimum mean is again too low by  $0^{\circ}08$ , and in December by  $0^{\circ}31$ .

In Tables XIX., XX. and XXI. we have respectively the mean monthly temperature and the corresponding mean maximum and mean minimum temperatures for each month of the 65 years, collected from Tables I. to III., adding here extremes and means and corresponding annual values. The mean annual temperature of the whole series being  $49^{\circ}56$ , the years having a lower temperature than  $48^{\circ}$  were 1845= $47^{\circ}60$ , 1853= $47^{\circ}96$ , 1855= $47^{\circ}20$ , 1860= $47^{\circ}47$ , 1879= $46^{\circ}28$ , 1887= $47^{\circ}94$  and 1888= $47^{\circ}78$ ; and those having a higher temperature than  $51^{\circ}$  were 1846= $51^{\circ}35$ , 1857= $51^{\circ}31$ , 1859= $51^{\circ}17$ , 1868= $52^{\circ}00$ , 1872= $51^{\circ}01$ , 1893= $51^{\circ}03$  and 1898= $51^{\circ}45$ . The years 1860 and 1879 were memorable for low summer temperature. The year of absolute maximum was 1868,  $52^{\circ}00$ , warmer than that of absolute minimum, 1879= $46^{\circ}28$ , by  $5^{\circ}72$ . In regard to secular change the 65 years were divided into five groups of 13 years each, and means of the annual values formed for mean temperature and mean maximum and minimum temperature. These, with the departure from the general average in each case, are as follows:—

| Period.      | Mean Temperature.             | Mean Maximum.                 | Mean Minimum.                 |
|--------------|-------------------------------|-------------------------------|-------------------------------|
| 1841—1853... | $49^{\circ}47$ $-0^{\circ}09$ | $57^{\circ}89$ $-0^{\circ}01$ | $42^{\circ}58$ $+0^{\circ}31$ |
| 1854—1866... | $49^{\circ}66$ $+0^{\circ}10$ | $58^{\circ}42$ $+0^{\circ}52$ | $42^{\circ}17$ $-0^{\circ}10$ |
| 1867—1879... | $49^{\circ}64$ $+0^{\circ}08$ | $58^{\circ}07$ $+0^{\circ}17$ | $42^{\circ}21$ $-0^{\circ}06$ |
| 1880—1892... | $48^{\circ}89$ $-0^{\circ}67$ | $57^{\circ}16$ $-0^{\circ}74$ | $41^{\circ}59$ $-0^{\circ}68$ |
| 1893—1905... | $50^{\circ}12$ $+0^{\circ}56$ | $57^{\circ}96$ $+0^{\circ}06$ | $42^{\circ}82$ $+0^{\circ}55$ |
| General Mean | $49^{\circ}56$                | $57^{\circ}90$                | $42^{\circ}27$                |

These differences are interesting, but are clearly accidental, that is, due to unascertained causes, and give really no information on secular change, for which purpose a very much longer period than 65 years is necessary.

Referring again to years of extreme high and low temperature, it may be seen by comparing together the values of Tables XIX. and XXII. that the warm years tend to have a greater, and the colder years a lesser, mean diurnal range. These differences are mainly due to the influence of summer. A warm summer is one of diminished cloud, inducing large diurnal range; a cold summer is one of increased cloud, inducing a lesser diurnal range. One

state is a direct accompaniment of the other. The warm summers of 1868 and 1893 were summers of diminished cloud, and the cold summers of 1860 and 1879 summers of increased cloud, the influence of which conditions is seen in the monthly values of diurnal range in the summers of the years mentioned, as given in Table XXII.

As further indicating the extreme climatic variations experienced in months of different years, the highest monthly mean summer temperature (Table XIX.) was that of July, 1859= $68^{\circ}9$ , the lowest month of winter temperature being that of February, 1895= $29^{\circ}1$ , showing a divergence between summer and winter of  $39^{\circ}8$ . Conversely, the month of lowest summer temperature was that of June, 1871= $55^{\circ}5$ , and that of highest winter temperature that of December, 1852= $47^{\circ}6$ , a difference between summer and winter of  $7^{\circ}9$  only as compared with the greater divergence of  $39^{\circ}8$ .

In following tables, XXIII. to XXXIII., much information is given in regard to the variations and irregularities of atmospheric temperature, to some of the more striking points only of which will it be possible here to refer. In Table XXIII. we have the highest daily maximum and lowest daily minimum temperature recorded in each of the 65 years. The absolute highest was  $97^{\circ}1$  on July 15, 1881, and the absolute lowest  $4^{\circ}0$  on January 9, 1841, a difference of  $93^{\circ}1$ . It so happens that this day of absolute maximum, July 15, is also the day of highest mean temperature (65 years),  $64^{\circ}01$ , in Table V. as before mentioned, a value which in this table is distinctly higher than adjacent values before and after. The highest daily temperature of summer occurred in 4 years in May, in 11 years in June, in 32 years in July, in 16 years in August, and in 2 years in September; and the lowest daily temperature of winter occurred in 3 years in November, in 17 years in December, in 24 years in January, in 13 years in February, and in 8 years in March.

Table XXIV. deals with the comparative severity of cold in successive winters. Therein is set out the number of days in individual months of the 65 years on which the temperature fell to or below the freezing point. The average yearly number of such wintry days was 54, of which 18 occurred before and 36 after the end of the year. As the day lengthens so the cold strengthens; the coldest portion of the winter coming some weeks after the December solstice, as also the warmest portion comes some weeks after the June solstice. Winters having 80 or more days of this character were those following 1846, 1854, 1878, 1886, 1887 and 1890; and winters having fewer than 30 of such days were those following 1845, 1850, 1883, 1895 and 1897. In the three successive winters following the year 1878 there were in the aggregate 224 of these wintry days; and the average for three years being 162, this indicates an excess of 38 per cent. of such days continued through three winters. Again, in the three successive winters following the year 1885 the wintry days numbered 245, indicating an excess of 51 per cent. above the average continued through three winters.

Contrasting with these high numbers there were in the three successive winters following the year 1895 only 96 similar days, indicating a diminution of 41 per cent. of days continuously through three winters. In Table XXV. we further have the latest day in spring and the earliest day in autumn in each year on which the temperature fell to or below the freezing point, from which we see that the latest day in spring in any year that this occurred was May 24, 1867= $31^{\circ}9$ ; and the earliest day in autumn, September 27, 1885= $30^{\circ}6$ . In the whole 65 years there were 41 instances in all of temperature in May below the freezing point; four times in 1877, and three times in each of the years 1852, 1855, 1857, 1870, 1876 and 1879, or 22 of the 41 instances occurring in seven years. On these occasions there would naturally be a more severe ground frost. Continuing the particulars as regards cold, it appears by Table XXVI. that during the whole period the temperature fell to or below  $20^{\circ}$  on 176 days, the degree of cold and day of occurrence being given. The absolute lowest was on January 9, 1841= $4^{\circ}0$ , as already once mentioned, and there were in all 10 cases of temperature below  $10^{\circ}$  (including one of  $10^{\circ}0$ ). Months excessively severe were those of February, 1855, temperature below  $20^{\circ}$  on 10 days (lowest= $11^{\circ}1$ ); January, 1881, below  $20^{\circ}$  on 10 days (lowest= $12^{\circ}7$ ), and February, 1895, below  $20^{\circ}$  on 11 days (lowest= $6^{\circ}9$ ). Other information is given concerning periods during which the temperature remained continuously below freezing. On 14 days during the whole period the maximum daily temperature never reached  $25^{\circ}$ . The most remarkable case is that of March 13, 1845, with a maximum of  $24^{\circ}8$ , a unique circumstance, of which I have myself distinct recollection.

Tables XXIX. to XXXIII. contain information principally in regard to higher temperatures. The average number of days in the year with maximum temperature of  $70^{\circ}$  or above is 76. The years having more than 100 of such days were, 1846=108, 1857=100, 1858=104, 1859=103 (three years in succession), 1865=132, 1868=108, 1893=104 and 1895=101. There were nine years in which the numbers of such days were few, in seven years ranging from 49 to 57, but in the two years 1860 and 1879 the numbers fell to 28 and 30 respectively. On 55 days during the whole period the temperature rose to  $90^{\circ}$  or above, of which 6 days were in June, 32 in July, 15 in August and 2 in September. The earliest day in any year was June 16, 1858= $94^{\circ}5$ , and the latest day September 8, 1898= $92^{\circ}1$ .

Reverting now to the accompanying chart of variations of temperature at Greenwich, there is therein exhibited the mean temperature of the air (average of 65 years) on each day of the year with corresponding mean maximum and mean minimum temperature, also curves indicating the highest daily maximum and the lowest daily minimum recorded on each day of the year, founded on the numbers of Tables V., VIII., X. and XVII. The three centre

curves, mean maximum, mean temperature, and mean minimum, although depending on the observations of 65 years, show many irregularities, for the most part accidental, that is to say, in the sense of their direct cause being unattainable, to eliminate which a very long period of time would be necessary. Some of the inflections may, however, be real, that is such as more extended observation would intensify. One peculiarity of the curves of extreme daily maximum and extreme daily minimum is the small amplitude of the variations of the maximum in winter as compared with summer, and the greater amplitude of the variations of the minimum in winter as compared with summer. In clear weather under a hot summer sun the daily maximum may rise to 90° or more, but in winter the sun at a low altitude has no such corresponding power. Conversely, in clear weather in winter, the nightly minimum may descend to anything approaching zero; but in the short nights of summer such arctic influences are absent. These circumstances may be indicated numerically by extracting the numbers for a summer and a winter month from Tables V. and XVIII. :—

|                                          | July. | January. |
|------------------------------------------|-------|----------|
| Mean monthly temperature.....            | 62·7  | 38·6     |
| Mean monthly highest daily maximum ..... | 90·9  | 54·7     |
| Mean monthly lowest daily minimum .....  | 43·5  | 15·5     |
| Maximum higher than mean .....           | 28·2  | 16·1     |
| Minimum lower than mean.....             | 19·2  | 23·1     |

Thus in summer the maximum rises to a greater extent above the mean than the minimum descends below it, and conversely in winter.

Temperature is the most important factor in meteorology, consequent on its variations being primarily due to action of the sun. Not by the influence of sunspot variation, which, if assignable, is practically insignificant in all questions of weather change. It is from the direct action of solar heat that all else flows—the seasonal variation, winter and summer; the diurnal variation, day and night; atmospheric currents, winds and storms, and also evaporation, cloud, and rainfall, and these are the elements that produce, in all its varied conditions, what we call weather.



## ROYAL METEOROLOGICAL SOCIETY.

THE opening meeting of the new session was held on Wednesday evening, November 20th, at the Institution of Civil Engineers, Great George Street, Westminster, the President, Dr. H. R. Mill, being in the chair.

The President, in a few introductory remarks, referred to several points of interest in connection with the work of the Society, and also to some important changes which have occurred in colonial and foreign meteorological organizations. He congratulated the Society on the large number of new Fellows to be ballotted for that evening, and the still larger number to be proposed.

The meeting was largely devoted to the consideration of the Reports on the results obtained by the balloon observations made in the British Isles, July 22nd to 27th. The International Aeronautical Committee has for some years set apart the first Thursday in each month for the ascent of kites and balloons, but at the conference held at Milan last year, it was decided to make a special effort to obtain information on a series of consecutive days, and the last week in July was finally decided upon for the purpose.

The Joint Kite Committee of the Royal Meteorological Society and the British Association, and the Meteorological Office, participated in the work, and organized the following stations in the British Isles, *viz.*, Pyrton Hill, Oxon, and Crinan, on the west coast of Scotland, both under the direction of Mr. W. H. Dines, F.R.S.; Manchester, under the direction of Mr. J. E. Petavel, F.R.S.; Selkirk, Herefordshire, Capt. C. H. Ley, R.E.; Ditcham Park, Petersfield, Mr. C. J. P. Cave; and Dublin, Prof. W. E. Thrift.

Twenty-five balloons, with registering instruments, were sent up during the week, and fourteen of these have been found. Nearly all the balloons drifted to the eastward, but several which reached a fair height fell within 20 miles of their starting point. The heights ranged up to over  $12\frac{1}{2}$  miles, the average being about  $7\frac{1}{2}$  miles. It has been known for some time that after a certain height is reached the air temperature ceases to fall. This layer is of variable height, and is known as the region of the "great inversion." Above this comes the isothermal region, where the temperature remains almost unaltered with change of height. The ascents which have been made in England have proved the existence of the isothermal conditions about  $7\frac{1}{2}$  miles. There also seems to be some slight evidence that the air at extreme heights is warmer in the evening than in the morning.

A paper giving a "Discussion of the Meteorological Observations at the British Kite Stations, 1906-7," by Miss M. White, Mr. T. V. Pring and Mr. J. E. Petavel, F.R.S., was also read. Investigations of the upper air by means of kites carrying meteorographs are carried



out at four British stations, *viz.*, Pyrton Hill, Oxon; Ditcham Park, Petersfield; Brighton; and Glossop Moor, Derbyshire. The authors have made an analysis of the records obtained during the past session. Under ordinary circumstances the air temperature decreases continually with increasing height. The rate of fall is, in the daytime, very rapid close to the ground and diminishes at higher levels. The temperature gradient varies with the direction and the velocity of the wind, and also with the amount of cloud, being greatest for a north-west wind and on clear and fine days. It appears that the direction of the wind alters at high levels, rotating in a clock-wise direction, thus a south wind tends to become more westerly.

The President, Mr. W. H. Dines, Mr. J. E. Petavel, Mr. W. Marriott, Mr. C. J. P. Cave, Capt. C. H. Ley, Dr. W. N. Shaw and Mr. J. E. Clark, spoke on the above papers.

The following were elected Fellows of the Society:—

Mr. W. S. Allely, Mr. H. G. Banerji, M.A., Lieut. E. H. Bate, R.N., Mr. R. J. Clarke, Mr. A. Dallas, Mr. C. N. Day, Mr. J. Desmond, Capt. J. Elmes, Capt. H. Findlay, Capt. E. Gates-James, Mr. W. Gaw, Mr. H. Gorsain, Capt. G. Gregory, Capt. H. Hollies, Mr. H. J. Hunt, Mr. A. Lander, Capt. W. G. Lingham, Capt. A. W. McKellar, Mr. E. N. Plevins, Capt. S. W. V. Plunkett, Mr. T. Rule, Capt. R. W. Scarff, Capt. W. S. Shelford, Mr. E. J. Walsh, and Capt. R. C. Warden.

## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

### FOG IN TOWN AND COUNTRY ON NOV. 11th & 20th.

ON November 11th I noticed a striking instance of the dryness of London fog as compared with nearly simultaneous fog at a place 15 miles away in the outer suburban area—to all intents and purposes perfect country. Travelling to town in the middle of the day I have only to record passing through several dense banks of damp white fog on the journey. The afternoon in London was hazy but sunny, with every promise of thick fog settling down before nightfall. At 7.0 p.m. a thick dry fog prevailed, with the pungent fumes of oxide of sulphur very noticeable; torches were carried in the streets and fires stationed at street junctions. I left Marylebone station at 7.30 p.m., and reaching Northwood at 8.30 (the train was half-an-hour late), found the fog just as dense as in town, but perfectly pure and extremely *wet*—so wet that drizzling rain was falling. This instance struck me as a good illustration of the drying qualities attaching to the large carbonaceous nuclei of town fog.

It may be interesting also to place on record that while Nov. 20th

was a day of darkest night in town through *overhead* fog, there was no surface fog. At Northwood, and I suppose in the country generally immediately to the north of London, there was a thick yellowish-white surface-fog all day, but no darkness. Can any readers supply particulars as to the qualities of fog or weather on this day in their respective neighbourhoods?

L. C. W. BONACINA.

*Northwood, Middlesex, Nov. 21st, 1907.*

## THE THUNDERSTORM IN SOUTH-EAST CLARE ON THE 22nd JULY, 1907.

IN continuation of his article in the August Magazine (Vol. 42, p. 133), Colonel W. A. Bentley sends us the following copy of a letter from R. S. Parker, Esq., J.P. :—

“It was the second thunderstorm which did the damage here on the 22nd ult. We had heavy thunder all that afternoon over towards Keeper, and working on by Thontina; but about 5.30 p.m. we began to hear another thunderstorm towards the S.W., working, as you say, to the N.E. The thunder and lightning soon got very bad, but no rain till after seven. Then it poured sometimes more and sometimes less, when about eight a flood burst on us from above, which swept the garden wall, some 20 yards broad, cut a chasm through the ground at the top of the garden, and filled up the bottom with stones and gravel. Then the water rose in our back yard several feet high, and in another moment would have inundated the house, only fortunately the yard wall gave way and let it off, leaving offices and yard full of mud and gravel. Then it carried away about 15 yards of wall near my gate lodge, to say nothing of destroying about four acres of hay—cut and uncut—and putting stones and gravel on the land. I think there must have been a small waterspout up behind us, for though the rain was desperate it seemed hardly sufficient to make such a torrent.

“The stream is usually quite a small one, only starting a few fields above us. The Board of Works people, who keep a rain gauge, say there was  $3\frac{1}{2}$  inches of rain, and I fancy we had more here even than they had at Killaloe. I have not been up the glen, but I saw Ballycorney bridge, which is ready to fall. A fine bridge near Garranboy is gone altogether, and a very deep hole washed out at the lower side of Ballyheigue bridge. It will cost the county a good bit of money. I am afraid my observations of the storm from a meteorological point of view are of no interest. You seem to have told them pretty accurately as to the hours and direction of the storm. There was a waterspout seen over the lake on the 22nd by a great many people.”

*Bally Valley, Killaloe, co. Clare, 12th August, 1907.*

He adds that Bally Valley House, where Mr. Parker lives, is situate a mile north of Killaloe, on the side of the mountain overlooking Lough Derg, which is the lake he mentions. The house is high above the Shannon.

## OZONE.

WILL you grant me a small space in the *Meteorological Magazine* to ask if any recent research has been made as to the testing of Ozone in the air? If so, we should have a better, or say more scientific, definition of the element; and whether the symbol Oz is the proper expression, or what? I suppose it is the province of the chemist rather than of the meteorologist to determine the point.

It is some years since Dr. R. H. Scott in his "Instructions" gave the following opinion, as expressed by the Vienna Congress:—"The existing methods of determining the amount of ozone in the atmosphere are insufficient, and the Congress therefore recommends investigations for the discovery of better methods."

Have any investigations been made all these years?

If you would kindly stimulate the matter into activity you would do a good service. We should know once for all whether it is worthy of a proper recognition.

TURNOR PEEL.

*Deal, 23rd November, 1907.*

## THE GREENWICH SUMMER OF 1907.

THERE is an unfortunate misstatement in my letter on p. 196; it looks as if a line had slipped out.

The correct statement is to this effect: "On 69 of the 92 days the mean temperature was under the (day) average, and the thermometer never (in those three months) got above the seventies, though, &c." Perhaps you will kindly correct in your next issue.

ALEX. B. MACDOWALL.

*Brooklyn, Letchworth, 21st November, 1907.*

## OCTOBER, 1907.

RAIN fell on twenty-five days, the total being 7·47 inches. There were heavy falls as under: 14th ·82 in., 17th 1·06 in., 18th ·78 in., 19th ·42 in., 20th ·35 in., 28th ·47 in., 29th 1·00 in. It was a wet month without any dry periods. Our ten year average for the month is 4·48 in.; for the ten months, January–October, 27·28 in. The ten months of 1907 have totalled 27·65 in., or ·37 in. in excess of average. The October rainfall has exceeded 7 inches as under; the figures, with the exception of 1907, are Mr. Penfold's, and go back to 1873.

|               |          |
|---------------|----------|
| October, 1882 | 8·16 in. |
| " 1889        | 7·93 "   |
| " 1891        | 8·80 "   |
| " 1903        | 9·21 "   |
| " 1907        | 7·47 "   |

T. P. NEWMAN.

*Hazellurst, Haslemere, Surrey.*

## REVIEWS.

*Results of the Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, in the year 1905, under the direction of Sir W. H. M. Christie, K.C.B. . . .* Published by order of the Board of Admiralty in obedience to His Majesty's command. Edinburgh, Printed for His Majesty's Stationery Office, 1906. Size  $12\frac{1}{2} \times 10$ . Pp. 8 + lviii. + (cxxxviii).

THIS invaluable record of the meteorology of the London district is arranged on the familiar plan. It is to be regretted that the hour of observations on Sundays is different from that on the other six days of the week, and that certain observations are omitted on "Sundays and a few other days"; but a more regrettable circumstance about the meteorological equipment of this national observatory is the absence of a rain gauge of the deep vertical rim pattern, now happily in use at all stations of the Meteorological Office, of the Royal Meteorological Society, and of most private observers. The absence of a Dines' pressure tube anemometer is another matter of regret; and we believe that were a meteorologist appointed to the Board of Visitors, the desirability of bringing the efficiency and completeness of the meteorological equipment into line with the astronomical and magnetic departments would be urged upon those responsible with a force that external criticism cannot bring to bear.

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*Hourly Readings obtained from the self-recording instruments at four observatories in connection with the Meteorological Office, 1906.* Thirty-eighth year. New series. Vol. VII. London: Printed for His Majesty's Stationery Office, 1907. Size,  $12 \times 10$ . Pp. xiv. + 198. Price, 25s.

WE offer our hearty congratulations to the Meteorological Office on the early appearance of this volume, which, by the new method of publication in monthly numbers, is available when most likely to be useful. But by what system of official arithmetic 12 monthly numbers at 6d. each, with 14 pp. of introduction, are priced at 25s., in a blue paper cover, we are at a loss to understand.

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*Grundzüge einer Theorie der synoptischen Luftdruckveränderungen, II. Mitteilung* [Principles of a theory of synoptic pressure changes. Second communication], von FELIX M. EXNER. Aus den Sitzungsberichten der k. Akademie der Wissenschaften in Wien. Math.-Naturw. Klasse Bd., CXVI. Abt. IIa. Wien, 1907. Size,  $9\frac{1}{2} \times 6\frac{1}{2}$ . Pp. 36. Plates.

THIS is the continuation of the investigation, the first part of which was noticed in the May number, p. 73. Dr. Exner explains that he

treats the discussion of the diurnal variations merely as a hypothesis, though in time it may be so developed as to be of service in weather predictions. The treatment of the subject in the present communication is more general than in the earlier.

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*Internationale Meteorologische Kodex. Im Auftrage des International Meteorologischen Komitees, bearbeitet von* [International Meteorological Code. Prepared on behalf of the International Meteorological Committee by] G. HELLMANN, Berlin, und H. H. HILDEBRANDSON, Upsala. Deutsche Ausgabe. Berlin, 1907. Behrend & Co. Size, 11 × by 7½. Pp. viii. + 82.

THE German edition of a systematic collection of the Resolutions passed at the meetings of the International Meteorological Committee since 1871, which have hitherto appeared only in the various volumes of Minutes. The resolutions are arranged under the heads of the various meteorological phenomena dealt with, and there is a complete index embracing authors and subjects.

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*Returns of Rainfall, &c., in Dorset for 1906*, by H. STILWELL. From *Proceedings Dorset Natural History and Antiquarian Field Club*. Dorchester, 1907. Size, 8½ × 5½. Pp. [14].

*The Cornwall County Council Annual Report. Vital Statistics and Meteorological Summary for 1906*. Truro, 1907. Size, 11 × 8½. Pp. 28.

THESE are some of the valuable county reports dealing mainly with rainfall that we have received, and we must acknowledge also, with regret, that our space will not admit of a more adequate notice, the reports for 1906 of the Fernley Observatory, *Southport*, admirably edited as usual by Mr. Baxendell, the *Bath Health Reports* by Dr. Symons, the indefatigable Medical Officer of Health, the *Falmouth Observatory*, where Mr. Kitto's name is a guarantee of first-class work, Mr. A. W. Preston's meteorological notes for *Norwich*, and the *Coats' Observatory, Paisley*, where Mr. Donald Maclean reports for the Observatory Committee of the Paisley Philosophical Institution.

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*A Discussion of the Anemographic Observations recorded at Rangoon from 1878 to 1901 . . . . at Chittagong from 1879 to 1896 . . . . at Allahabad from 1890 to 1904 . . . . from 1878 to 1892*, by SIR JOHN ELIOT, M.A., F.R.S., K.C.I.E. *Memoirs of the Indian Meteorological Department*. Vol. XVIII., part 1, Calcutta, 1907, Vol. XVIII., part 3, London, 1907. Size, 12 × 9½. Pp. 1-122, 283-430, with plates.

THIS important discussion of the winds at various stations in India, where anemometer records are available, is copiously illustrated by wind-roses, curves of diurnal variations of the wind, and other diagrams.

*An account of the preparations made for the determining the conditions of the Upper Air in India by means of Kites*, by J. A. FIELD, ESQ., B.A., Deputy Meteorologist. *Memoirs of the Indian Meteorological Department*. Vol. XX. Part I. Calcutta, 1906. Size,  $12 \times 9\frac{1}{2}$ . Pp. 16. Plates.

PARTICULARS of the instruments and methods, with the record of ascents near Karachi.

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*Mysore Government Meteorological Department. Fourteenth Annual Report on Meteorology in Mysore, 1906. Report on Rainfall Registration in Mysore, 1906.* By JOHN COOK, M.A., F.R.S.E. Bangalore, 1907. Size,  $12 \times 10$ . Pp. xviii. + 122 + 48. Plates.

MR. COOK is much to be congratulated on the promptitude with which he has completed his annual volumes and carried them through the press.

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*The Windrush at Biggin.* By J. E. CLARK, B.A., B.Sc. [Privately printed]. Size,  $9\frac{1}{2} \times 6$ , pp. 4. Plates.

THE "windrush" in question is not the tributary of the Thames, but a severe squall which occurred at Biggin, near Church Fenton, Yorkshire, during the passage of the famous line-squall of 8th February, 1906. Mr. Clark gives an excellent description of the damage done, illustrated by maps of the line-squall and photographs of the wrecked farm-buildings, the tiles of which were reported to have been blown about like feathers.

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*Ueber tatsächliche vieltägige Perioden des Luftdruckes* [On actual many-day periods of atmospheric pressure]. Von PROF. DR. E. HERRMANN. Sonderabdruck aus "Annalen der Hydrographie, &c." 1907. Size,  $10\frac{1}{2} + 7\frac{1}{2}$ . Pp. 8. Plates.

THE author believes that a solution of the varied and apparently chaotic movements of the barometer may be found in considering atmospheric disturbances to be due to the combination of onward moving waves of different velocities and the surge-like swingings of air to and fro without progressive movement. He traces a 51 and 59-day periodicity in atmospheric pressure, in which he sees evidence of lunar influence.

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*The Climatology of Ireland in relation to the Public Health.* By SIR JOHN W. MOORE, M.D., &c. (From *Journal of Royal Sanitary Institute*, Vol. 28 (1907), No. 8.) Size,  $10 \times 7$ . Pp. 12.

AN address given at the recent conference of the Royal Sanitary Institute in Dublin. The author says :—"And speaking of climate

in general and of the climate of Ireland in particular, I may frankly state that the latter is probably the most temperate climate in the world, as it is certainly most conducive to health and to longevity."

*Notes on Maritime Meteorology.* By M. W. CAMPBELL HEPWORTH, C.B., Commander R.N.R. (Retired). With 7 plates. London, George Philip & Son, Ltd., 1907. Size,  $8\frac{1}{2} \times 5\frac{1}{2}$ . Pp. viii. + 90.

CAPTAIN HEPWORTH has conferred an obligation on more than sailors in bringing together the seven chapters of this little book. Each chapter was prepared separately for the most part from his own observations and communicated to the Royal Meteorological Society, the Royal United Service Institute, the Royal Society of New South Wales and the London Shipmasters' Society; but in the scattered publications of these institutions it was a serious matter to consult them all. The chapters bear the following titles:—I. Meteorology—a Factor in Naval Warfare; II. The Value of Meteorological Observations at Sea and some hints upon observing; III. Weather Forecasts and Storm Warnings on the Coast of South Africa; IV. Wind Systems and Trade Routes between the Cape of Good Hope and Australia; V. The Tracks of Ocean Wind Systems in transit over Australasia; VI. Current Observations on the Canadian-Australian route; VII. Remarks on the Weather Conditions of the steamship track between Fiji and Hawaii.

*Regenkarte von Deutschland, mit erläuternden Bemerkungen. Im amtlichen Auftrage bearbeitet von* [Rainfall Map of Germany, with explanatory notes. Prepared officially by] Professor DR. G. HELLMANN. Berlin, 1906. Dietrich Reimer. Size,  $12\frac{1}{2} \times 10$ . [Map folded.] Price 3 marks.

THIS map appeared with Dr. Hellmann's three great volumes on German Rainfall. It is on the scale of 1:1,800,000, or about 29 miles to an inch, and has been prepared from the records at 3000 stations for the period of ten years, 1893—1902. The map is coloured in lightening shades of brown from the lowest rainfall up to 60 centimetres ( $23\frac{1}{2}$  in.), and then, in deepening shades of blue, up to the highest rainfall shown; so that the browner the country is shown the drier it is, and the bluer the wetter. The result is very effective in distinguishing the wetter and drier parts of the country. The map shows in a very beautiful manner the dependence of rainfall on the configuration of the land, and on distance from the sea whence the prevailing winds blow. It should interest both students and practical men, and its very low price (3s.) and fine execution are worthy of remark.

## METEOROLOGICAL NEWS AND NOTES.

THE COMMONWEALTH OF AUSTRALIA has inaugurated a Meteorological Bureau for the whole continent, with its headquarters in Melbourne, and Mr. H. A. Hunt has been appointed the first Commonwealth Meteorologist. This is an event of very great importance in the meteorological world, for the new Bureau will have control of the weather service over an area scarcely less than that of the United States or the Dominion of Canada, and very much larger than that of India.

THE TEACHING OF ELEMENTARY METEOROLOGY of the simplest kind in schools has recently been attracting considerable attention. The Council of the Royal Meteorological Society desire to encourage such teaching, and they are inviting elementary teachers and others to send in essays in the form of an original Nature Study lesson on Weather or Climate (not exceeding 1,500 words in length), together with a brief synopsis of five other lessons to cover the whole subject of Climate and Weather. If essays of sufficient merit are received, three prizes will be awarded of £5, £3 and £2, respectively. The essays are to be sent in before January 31st, 1908, and addressed to Mr. William Marriott, Assistant Secretary, Royal Meteorological Society, 70, Victoria Street, London, S.W., from whom further information can be obtained. This prize competition will, no doubt, stimulate many teachers to take an interest in the subject, and to impart to their scholars some definite teaching on it.

MESSRS. C. F. CASELLA & Co. send us two illustrated catalogues, one of Richard's self-recording instruments, with a supplement giving a selection of the firm's own instruments, and the second dealing with anemometers, air meters and wind direction instruments. Many of these instruments are both interesting and ingenious. We note that Professor A. Laurence Rotch's instrument for ascertaining the true direction of the wind on board a rapidly moving steamer is included in the list. Both pamphlets are models of clear description and attractive printing.

THE FRANCO-BRITISH EXHIBITION OF 1908 will contain a section representative of British Science, and a fair amount of space will be devoted to meteorology. If any reader proposes to lend instruments of historic interest for the department of meteorology, an early intimation should be made to Dr. W. N. Shaw, 63, Victoria Street, S.W., the Convenor of the Sub-Committee on Meteorology.

RAINFALL OBSERVERS ARE REMINDED that any changes in the pattern or position of their rain gauges should be made on January 1st, and it would be well if all Observers were to make a careful inspection of their gauges so as to be sure that they are in good condition and not unduly sheltered. A copy of a revised edition of the Rules for Rainfall Observers will be sent free on application to Dr. H. R. Mill, 62, Camden Square, London, N.W.



## TEMPERATURE FOR NOVEMBER, 1907.

| STATION.                           | COUNTY.              | Lat.<br>N. | Long.<br>W.<br>[°E.] | Height<br>above<br>Sea.<br>ft. | TEMPERATURE. |            |      |        | No. of Nights<br>at or below 32° |        |
|------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------|------------|------|--------|----------------------------------|--------|
|                                    |                      |            |                      |                                | Max.         |            | Min. |        | Shade.                           | Grass. |
|                                    |                      |            |                      |                                | °            | Date.      | °    | Date.  |                                  |        |
| Camden Square.....                 | London.....          | 51 32      | 0 8                  | 111                            | 60·4         | 9          | 30·1 | 16     | 3                                | 9      |
| Tenterden.....                     | Kent.....            | 51 4       | 0 41                 | 190                            | 60·0         | 9          | 30·0 | 12     | 4                                | 9      |
| West Dean.....                     | Hampshire.....       | 51 3       | 1 38                 | 137                            | 58·0         | 9          | 28·0 | 16     | 9                                | 17     |
| Hartley Wintney.....               | ".....               | 51 18      | 0 53                 | 222                            | 59·0         | 15, 16     | 25·0 | 16     | 7                                | 16     |
| Hitchin.....                       | Hertfordshire.....   | 51 57      | 0 17                 | 238                            | 56·0         | 2          | 25·0 | 29     | 10                               | ...    |
| Winalow (Addington).....           | Buckinghamsh. r.     | 51 58      | 0 53                 | 309                            | 57·0         | 2, 9       | 23·0 | 30     | 9                                | 13     |
| Bury St. Edmunds (Westley).....    | Suffolk.....         | 52 15      | 0 40                 | 226                            | 60·0         | 9          | 27·8 | 26     | 5                                | ...    |
| Brundall.....                      | Norfolk.....         | 52 37      | 1 26                 | 66                             | 57·6         | 9          | 28·0 | 26     | 5                                | 13     |
| Winterbourne Steepleton.....       | Dorset.....          | 50 42      | 2 31                 | 316                            | 57·9         | 9          | 26·8 | 16     | 5                                | 10     |
| Torquay (Cary Green).....          | Devon.....           | 50 28      | 3 32                 | 12                             | 60·0         | 3          | 36·5 | 16     | 0                                | 3      |
| Polapit Tamar [Launceston].....    | ".....               | 50 40      | 4 22                 | 315                            | 57·8         | 5          | 28·3 | 16     | 2                                | 13     |
| Bath.....                          | Somerset.....        | 51 23      | 2 21                 | 67                             | 58·7         | 9          | 27·0 | 16     | 6                                | ...    |
| Stroud (Upfield).....              | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 55·0         | 9          | 30·0 | 29     | 4                                | ...    |
| Church Stretton (Wolstaston).....  | Shropshire.....      | 52 35      | 2 48                 | 800                            | 55·0         | 9          | ...  | ...    | ...                              | ...    |
| Coventry (Kingswood).....          | Warwickshire.....    | 52 24      | 1 30                 | 340                            | 54·0         | 2, 9       | 27·0 | 15     | 6                                | ...    |
| Boston.....                        | Lincolnshire.....    | 52 58      | 0 1                  | 25                             | 55·0         | 1          | 26·0 | 26     | 4                                | ...    |
| Workshop (Hodsock Priory).....     | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 57·0         | 5          | 24·5 | 26     | 7                                | 17     |
| Derby (Midland Railway).....       | Derbyshire.....      | 52 55      | 1 28                 | 156                            | 57·0         | 2          | 26·0 | 29     | 9                                | ...    |
| Bolton (Queen's Park).....         | Lancashire.....      | 53 35      | 2 28                 | 390                            | 55·9         | 3          | 28·2 | 30     | 4                                | 12     |
| Wetherby (Ribston Hall).....       | Yorkshire, W.R.      | 53 59      | 1 24                 | 130                            | ...          | ...        | ...  | ...    | ...                              | ...    |
| Arncliffe Vicarage.....            | ".....               | 54 8       | 2 6                  | 732                            | ...          | ...        | ...  | ...    | ...                              | ...    |
| Hull (Pearson Park).....           | "..... E.R.          | 53 45      | 0 20                 | 6                              | 58·0         | 2          | 28·0 | 16†    | 6                                | 13     |
| Newcastle (Town Moor).....         | Northumberland.....  | 54 59      | 1 38                 | 201                            | ...          | ...        | ...  | ...    | ...                              | ...    |
| Borrowdale (Seathwaite).....       | Cumberland.....      | 54 30      | 3 10                 | 423                            | 58·5         | 2          | 26·7 | 26     | 3                                | ...    |
| Cardiff (Ely).....                 | Glamorgan.....       | 51 29      | 3 13                 | 53                             | ...          | ...        | ...  | ...    | ...                              | ...    |
| Haverfordwest (High Street).....   | Pembroke.....        | 51 48      | 4 58                 | 95                             | 55·8         | 5          | 29·1 | 21     | ...                              | 10     |
| Aberystwyth (Gogerddan).....       | Cardigan.....        | 52 26      | 4 1                  | 83                             | 58·0         | 5          | 23·0 | 29     | ...                              | ...    |
| Llandudno.....                     | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 56·2         | 4          | 32·2 | 30     | ...                              | ...    |
| Cargen [Dumfries].....             | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 55·0         | 2, 4       | 22·0 | 19     | 11                               | ...    |
| Lilliesleaf (Riddell House).....   | Roxburgh.....        | 55 31      | 2 46                 | 550                            | ...          | ...        | ...  | ...    | ...                              | ...    |
| Edinburgh (Royal Observatory)..... | Midlothian.....      | 55 55      | 3 11                 | 442                            | 55·3         | 4          | 29·9 | 25     | 3                                | 11     |
| Girvan (Pinmore).....              | Ayr.....             | 55 10      | 4 49                 | 207                            | 58·0         | 3          | 24·0 | 30     | 13                               | ...    |
| Glasgow (Queen's Park).....        | Renfrew.....         | 55 53      | 4 18                 | 144                            | 58·0         | 4          | 25·0 | 25     | 8                                | 23     |
| Tighnabruach.....                  | Argyll.....          | 55 55      | 5 14                 | 50                             | 48·0         | 2, 3, 4, 5 | 25·0 | 28     | 15                               | 15     |
| Mull (Quinish).....                | ".....               | 56 36      | 6 13                 | 35                             | 56·0         | 11         | ...  | ...    | ...                              | ...    |
| Dundee (Eastern Necropolis).....   | Forfar.....          | 56 28      | 2 57                 | 199                            | 55·5         | 4          | 26·3 | 25     | 9                                | ...    |
| Braemar.....                       | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | ...          | ...        | ...  | ...    | ...                              | ...    |
| Aberdeen (Cranford).....           | ".....               | 57 8       | 2 7                  | 120                            | 53·0         | 2, 4       | 24·0 | 18     | 15                               | ...    |
| Cawdor.....                        | Nairn.....           | 57 31      | 3 57                 | 250                            | ...          | ...        | ...  | ...    | ...                              | ...    |
| Invergarry.....                    | E. Inverness.....    | 57 4       | 4 47                 | 130?                           | ...          | ...        | ...  | ...    | ...                              | ...    |
| Loch Torridon (Bendamph).....      | W. Ross.....         | 57 32      | 5 32                 | 20                             | ...          | ...        | ...  | ...    | ...                              | ...    |
| Dunrobin Castle.....               | Sutherland.....      | 57 59      | 3 56                 | 14                             | 53·5         | 2          | 30·5 | 25     | ...                              | 6      |
| Castletown.....                    | Caithness.....       | 58 35      | 3 23                 | 100                            | 53·0         | 4, 14      | 21·0 | 25     | 12                               | 12     |
| Killarney (District Asylum).....   | Kerry.....           | 52 4       | 9 31                 | 178                            | 59·0         | 2          | 29·0 | 30     | ...                              | ...    |
| Waterford (Brook Lodge).....       | Waterford.....       | 52 15      | 7 7                  | 104                            | 56·0         | 2          | 26·0 | 21     | 8                                | ...    |
| Broadford (Hurdlestown).....       | Clare.....           | 52 48      | 8 38                 | 167                            | 54·0         | 2          | 27·0 | 24     | 12                               | ...    |
| Abbey Leix (Blandsfort).....       | Queen's County.....  | 52 56      | 7 17                 | 532                            | 56·0         | 2, 3       | ...  | ...    | ...                              | ...    |
| Dublin (Fitz William Square).....  | Dublin.....          | 53 21      | 6 14                 | 54                             | 56·1         | 4          | 29·8 | 25     | 2                                | 8      |
| Ballinasloe.....                   | Galway.....          | 53 20      | 8 15                 | 160                            | 62·0         | 2          | 20·0 | 25, 30 | 16                               | ...    |
| Clifden (Kylemore House).....      | ".....               | 53 32      | 9 52                 | 105                            | ...          | ...        | ...  | ...    | ...                              | ...    |
| Crossmolina (Enniscoe).....        | Mayo.....            | 54 4       | 9 18                 | 74                             | ...          | ...        | ...  | ...    | ...                              | ...    |
| Seaforde.....                      | Down.....            | 54 19      | 5 50                 | 180                            | 53·0         | 2, 3       | 28·0 | 24     | 7                                | 19     |
| Londonderry (Creggan Res.).....    | Londonderry.....     | 54 59      | 7 19                 | 320                            | ...          | ...        | ...  | ...    | ...                              | ...    |
| Omagh (Edenfel).....               | Tyrone.....          | 54 36      | 7 18                 | 280                            | ...          | ...        | ...  | ...    | ...                              | ...    |

and 26, 30.

## RAINFALL FOR NOVEMBER, 1907.

| RAINFALL OF MONTH. |       |                    |          |                   |             |     | RAINFALL FROM JAN. 1. |        |                      |          | Mean Annual 1870-1899. | STATION.               |
|--------------------|-------|--------------------|----------|-------------------|-------------|-----|-----------------------|--------|----------------------|----------|------------------------|------------------------|
| ver. 70-99.        | 1907. | Diff. from Av. in. | % of Av. | Max. in 24 hours. | No. of Days |     | Aver. 1870-99.        | 1907.  | Diff. from Aver. in. | % of Av. |                        |                        |
| in.                | in.   | in.                |          | in.               | Date.       |     | in.                   | in.    |                      |          | in.                    |                        |
| '45                | 2.16  | — .29              | 88       | .49               | 18          | 12  | 23.04                 | 19.24  | — 3.80               | 84       | 25.16                  | Camden Square          |
| '22                | 2.64  | — .58              | 82       | 1.29              | 26          | 11  | 25.62                 | 22.08  | — 3.54               | 86       | 28.36                  | Tenterden              |
| '25                | 2.75  | — .50              | 82       | .58               | 25          | 15  | 27.19                 | 24.96  | — 2.23               | 92       | 29.93                  | West Dean              |
| '03                | 2.23  | — .80              | 74       | .48               | 26          | 13  | 24.55                 | 23.78  | — .77                | 97       | 27.10                  | Hartley Wintney        |
| '56                | 2.27  | — .29              | 89       | .64               | 26          | 14  | 22.61                 | 21.25  | — 1.36               | 94       | 24.66                  | Hitchin                |
| '63                | 2.07  | — .56              | 79       | .63               | 26          | 18  | 24.48                 | 21.75  | — 2.73               | 89       | 26.75                  | Addington              |
| '50                | 2.39  | — .11              | 96       | .56               | 26          | 14  | 23.28                 | 21.73  | — 1.55               | 93       | 25.39                  | Westley                |
| '71                | 2.48  | — .23              | 92       | .58               | 26          | 19  | 23.27                 | 22.81  | — .46                | 98       | 25.40                  | Brundall               |
| '82                | 4.72  | — .10              | 98       | 1.30              | 8           | 20  | 34.87                 | 33.74  | — 1.13               | 97       | 39.00                  | Winterbourne St Martin |
| '71                | 4.09  | + .38              | 110      | .94               | 8           | 17  | 31.54                 | 28.85  | — 2.69               | 92       | 35.00                  | Torquay                |
| '29                | 3.50  | — .79              | 82       | .68               | 17          | 21  | 34.46                 | 31.66  | — 2.80               | 92       | 38.85                  | Polapit Tamar          |
| '06                | 2.23  | — .83              | 73       | .43               | 8, 25       | 17  | 27.99                 | 27.53  | — .46                | 98       | 30.75                  | Bath                   |
| '99                | 2.14  | — .85              | 72       | .39               | 8           | 17  | 27.37                 | 26.59  | — .78                | 97       | 29.85                  | Stroud                 |
| '18                | 3.12  | — .06              | 98       | .45               | 8, 25       | 20  | 30.12                 | 32.17  | + 2.05               | 107      | 33.04                  | Wolstaston             |
| '80                | 2.37  | — .43              | 85       | .50               | 24          | 13  | 26.77                 | 25.83  | — .94                | 96       | 29.21                  | Coventry               |
| '14                | 2.12  | — .02              | 99       | .57               | 24          | 16  | 21.51                 | 19.95  | — 1.56               | 93       | 23.30                  | Boston                 |
| '10                | 1.91  | — .19              | 91       | .40               | 26          | 19  | 22.68                 | 21.29  | — 1.39               | 94       | 24.70                  | Hodsock Priory         |
| '28                | 1.83  | — .45              | 80       | .36               | 24          | 21  | 23.90                 | 25.53  | + 1.63               | 107      | 26.18                  | Derby                  |
| '91                | 3.57  | — .34              | 91       | .82               | 22          | 21  | 38.24                 | 40.97  | + 2.73               | 107      | 42.43                  | Bolton                 |
| '23                | 3.20  | + .97              | 114      | .75               | 26          | 19  | 24.77                 | 26.68  | + 1.91               | 109      | 26.96                  | Ribston Hall           |
| '00                | 4.64  | — 1.36             | 77       | 1.00              | 22          | 22  | 54.55                 | 54.31  | — .24                | 99       | 60.96                  | Arncliffe Vic.         |
| '45                | 2.29  | — .16              | 94       | .73               | 26          | 17  | 24.66                 | 22.27  | — 2.39               | 90       | 27.02                  | Hull                   |
| '65                | 1.77  | — .88              | 67       | .45               | 26          | 20  | 25.35                 | 24.27  | — 1.08               | 96       | 27.99                  | Newcastle              |
| '91                | 11.43 | — 2.48             | 82       | 1.75              | 27          | 17  | 117.98                | 109.68 | — 8.30               | 93       | 132.68                 | Seathwaite             |
| '26                | ...   | — .97              | 77       | .60               | 22, 25      | 19  | 38.38                 | 34.78  | — 3.60               | 91       | 42.81                  | Cardiff                |
| '41                | 4.23  | — 1.18             | 78       | .82               | 22          | 21  | 42.66                 | 39.91  | — 2.75               | 94       | 47.88                  | Haverfordwest          |
| '68                | 4.40  | — .28              | 94       | .74               | 23          | 22  | 40.92                 | 42.46  | + 1.54               | 104      | 45.41                  | Gogerddan              |
| '38                | 2.46  | — .92              | 73       | .39               | 26          | 21  | 28.03                 | 24.17  | — 3.86               | 86       | 30.98                  | Llandudno              |
| '50                | 3.81  | — .69              | 84       | 1.18              | 26          | 13  | 38.75                 | 43.76  | + 5.01               | 113      | 43.43                  | Cargen                 |
| '29                | ...   | ...                | ...      | ...               | ...         | ... | 29.86                 | ...    | ...                  | ...      | 33.04                  | Riddell House          |
| '31                | 1.06  | ...                | ...      | .31               | 12          | 12  | ...                   | 26.42  | ...                  | ...      | ...                    | Edinburgh              |
| '48                | 6.40  | + 1.09             | 121      | 1.18              | 22          | 27  | 43.63                 | ...    | ...                  | ...      | 48.87                  | Girvan                 |
| '21                | 2.31  | — 1.17             | 66       | .60               | 22          | 18  | 32.27                 | 36.65  | + 4.38               | 114      | 35.80                  | Glasgow                |
| '43                | 5.76  | — .45              | 93       | .78               | 26          | 18  | 51.57                 | 56.86  | + 5.29               | 110      | 57.90                  | Tighnabruich           |
| '76                | 6.70  | + .27              | 104      | 1.07              | 26          | 19  | 51.05                 | 48.04  | — 3.01               | 94       | 57.53                  | Quinish                |
| '94                | 1.40  | — 1.36             | 51       | .80               | 26          | 12  | 26.22                 | 27.85  | + 1.63               | 106      | 28.95                  | Dundee                 |
| '47                | 3.15  | — .79              | 80       | ...               | ...         | ... | 32.92                 | 29.97  | — 3.95               | 88       | 36.07                  | Braemar                |
| '65                | 2.49  | — .98              | 72       | .77               | 26          | 14  | 29.62                 | 29.10  | — .52                | 98       | 33.01                  | Aberdeen               |
| '98                | 1.76  | — .89              | 66       | .45               | 12          | 14  | 26.84                 | 28.89  | + 2.05               | 108      | 29.37                  | Cawdor                 |
| '79                | 6.29  | + .31              | 105      | 1.60              | 13          | 10  | 49.33                 | 52.63  | + 3.30               | 107      | 56.00                  | Invergarry             |
| '26                | 9.37  | — .42              | 96       | 1.80              | 21          | 20  | 77.46                 | 81.81  | + 4.35               | 106      | 86.50                  | Bendamph               |
| '85                | 2.50  | — .76              | 77       | .91               | 26          | 11  | 28.21                 | 29.36  | + 1.15               | 104      | 31.60                  | Dunrobin Castle        |
| '91                | 2.08  | ...                | ...      | .30               | 26          | 21  | ...                   | 28.17  | ...                  | ...      | ...                    | Castletown             |
| '53                | 4.22  | — 1.63             | 72       | 1.03              | 21          | 19  | 51.47                 | 38.67  | — 12.80              | 75       | 58.11                  | Killarney              |
| '19                | 5.38  | + 1.47             | 138      | .94               | 4           | 16  | 34.99                 | 34.51  | — .48                | 99       | 39.30                  | Waterford              |
| '21                | 4.34  | + 1.15             | 136      | 1.15              | 27          | 19  | 30.10                 | 33.05  | + 2.95               | 110      | 33.47                  | Hurdlestown            |
| '60                | 3.83  | + .62              | 119      | .86               | 27          | 18  | 31.71                 | 33.96  | + 2.25               | 107      | 35.19                  | Abbey Leix             |
| '60                | 2.58  | — .02              | 99       | .53               | 26          | 14  | 25.36                 | 24.83  | — .53                | 98       | 27.75                  | Dublin                 |
| '25                | 3.61  | + .01              | 100      | .70               | 25          | 22  | 33.41                 | 33.02  | — .39                | 99       | 37.04                  | Ballinasloe            |
| '63                | 5.13  | — .60              | 91       | 1.27              | 21          | 25  | 71.24                 | 45.87  | + 1.18               | 103      | 80.23                  | Kylemore House         |
| '94                | 3.05  | — .89              | 77       | 1.00              | 27          | 14  | 44.69                 | 36.22  | + 1.25               | 104      | 50.50                  | Ennisce                |
| '19                | 3.28  | — .91              | 78       | .74               | 26          | 22  | 34.97                 | 42.86  | + 5.97               | 116      | 38.61                  | Seaford                |
| '53                | ...   | ...                | ...      | ...               | ...         | ... | 34.08                 | ...    | ...                  | ...      | 41.20                  | Londonderry            |
|                    |       |                    |          |                   |             |     |                       |        |                      |          | 37.85                  | Omagh                  |

## SUPPLEMENTARY RAINFALL, NOVEMBER, 1907.

| Div.  | STATION.                          | Rain<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|-----------------------------------|----------------|--------|-----------------------------------|-----------------|
| II.   | Abinger Hall .....                | 2.91           | XI.    | Rhayader, Tyrmynydd .....         | 3.81            |
| "     | Ramegate .....                    | 1.97           | "      | Lake Vyrnwy .....                 | 4.57            |
| "     | Hailsham .....                    | 3.05           | "      | Llangyhanaf, Plas Draw .....      | 2.43            |
| "     | Crowborough, Uckfield Lodge ..... | 2.98           | "      | Criccieth, Talarvor .....         | 2.74            |
| "     | Totland Bay, Aston House .....    | 2.71           | "      | Llanberis, Pen-y-pass .....       | 9.84            |
| "     | Emsworth, Redlands .....          | 2.54           | "      | Lligwy .....                      | 3.27            |
| "     | Alton, Ashdell .....              | 2.88           | "      | Douglas, Woodville .....          | 3.79            |
| "     | Newbury, Welford Park .....       | 3.22           | XII.   | Stoneykirk, Ardwell House .....   | 5.40            |
| III.  | Harrow Weald, Hill House .....    | 2.33           | "      | Dalry, The Old Garroch .....      | 5.53            |
| "     | Oxford, Magdalen College .....    | 2.09           | "      | Langholm, Drove Road .....        | 4.19            |
| "     | Bloxham Grove .....               | 1.73           | "      | Moniaive, Maxwellton House .....  | 3.71            |
| "     | Pitsford, Sedgebrook .....        | 2.09           | XIII.  | N. Esk Reservoir [Penicuik] ..... | 1.80            |
| "     | Huntingdon, Brampton .....        | 2.65           | XIV.   | Maybole, Knockdon Farm .....      | 3.80            |
| "     | Wisbech, Bank House .....         | 2.46           | XV.    | Campbeltown, Witchburn .....      | 4.99            |
| IV.   | Southend Water Works .....        | 2.16           | "      | Inveraray, Newtown .....          | 6.95            |
| "     | Colchester, Lexden .....          | 1.61           | "      | Ballachulish House .....          | 9.47            |
| "     | Newport, The Vicarage .....       | 2.22           | "      | Islay, Eallabus .....             | 5.82            |
| "     | Rendlesham .....                  | 1.83           | XVI.   | Dollar Academy .....              | 2.56            |
| "     | Swaffham .....                    | 2.58           | "      | Loch Leven Sluice .....           | 2.67            |
| "     | Blakeney .....                    | 1.96           | "      | Balquhider, Stronvar .....        | 5.53            |
| V.    | Bishops Cannings .....            | 2.39           | "      | Perth, Pitculen House .....       | 1.97            |
| "     | Ashburton, Druid House .....      | 5.88           | "      | Coupar Angus Station .....        | 1.85            |
| "     | Okehampton, Oaklands .....        | 3.37           | "      | Blair Atholl .....                | 2.15            |
| "     | Hartland Abbey .....              | 3.27           | "      | Montrose, Sunnyside Asylum .....  | 2.10            |
| "     | Lynmouth, Rook House .....        | 2.78           | XVII.  | Alford, Lynturk Manse .....       | 2.36            |
| "     | Probus, Lamellyn .....            | 6.52           | "      | Keith Station .....               | 1.81            |
| "     | Wellington, The Avenue .....      | ...            | XVIII. | N. Uist, Lochmaddy .....          | 4.53            |
| "     | North Cadbury Rectory .....       | 3.26           | "      | Alvey Manse .....                 | 1.93            |
| VI.   | Clifton, Pembroke Road .....      | 3.11           | "      | Loch Ness, Drumnadrochit .....    | 3.12            |
| "     | Ross, The Graig .....             | 2.26           | "      | Glencarron Lodge .....            | 7.11            |
| "     | Shifnal, Hatton Grange .....      | 2.28           | "      | Fearn, Lower Pitkerrie .....      | 2.16            |
| "     | Cheadle, The Heath House .....    | ...            | XIX.   | Invershin .....                   | 2.57            |
| "     | Blockley, Upton Wold .....        | 1.88           | "      | Altnaharra .....                  | 2.73            |
| "     | Worcester, Boughton Park .....    | 2.16           | "      | Bettyhill .....                   | 1.96            |
| VII.  | Market Overton .....              | 2.33           | XX.    | Dunmanway, The Rectory .....      | 4.29            |
| "     | Market Rasen .....                | 2.13           | "      | Cork .....                        | 3.93            |
| "     | Bawtry, Hesley Hall .....         | 2.04           | "      | Darrynane Abbey .....             | 3.59            |
| VIII. | Neaton, Hinderton Lodge .....     | 2.58           | "      | Glenam [Clonmel] .....            | 4.25            |
| "     | Southport, Hesket Park .....      | 2.74           | "      | Ballingarry, Gurteen .....        | 3.16            |
| "     | Chatburn, Middlewood .....        | 3.47           | "      | Miltoyn Malbay .....              | 4.59            |
| "     | Cartmel, Flookburgh .....         | 5.19           | XXI.   | Gorey, Courtown House .....       | 3.75            |
| IX.   | Langsett Moor, Up. Midhope .....  | 4.42           | "      | Moynalty, Westland .....          | 2.68            |
| "     | Scarborough, Scalby .....         | 2.62           | "      | Athlone, Twyford .....            | 2.34            |
| "     | Ingleby Greenhow .....            | 3.02           | "      | Mullingar, Belvedere .....        | 2.59            |
| "     | Mickleton .....                   | 1.90           | XXII.  | Woodlawn .....                    | 3.08            |
| X.    | Bardon Mill, Beltingham .....     | 1.47           | "      | Westport, Murrisk Abbey .....     | ...             |
| "     | Ewesley, Fallowles .....          | 2.39           | "      | Collooney, Markree Obay .....     | 2.89            |
| "     | Ilderton, Lilburn Cottage .....   | 2.03           | "      | Mohill .....                      | 2.57            |
| "     | Keswick, York Bank .....          | 5.34           | XXIII. | Enniskillen, Portora .....        | 2.33            |
| XI.   | Llanfrechfa Grange .....          | 3.91           | "      | Warrenpoint, Summer Hill .....    | 2.39            |
| "     | Treherbert, Tyn-y-waun .....      | 6.29           | "      | Banbridge, Milltown .....         | 2.36            |
| "     | Carmarthen, The Friary .....      | 5.13           | "      | Belfast, Springfield .....        | 2.93            |
| "     | Castle Malgwyn [Lechryd] .....    | 3.60           | "      | Bushmills, Dundarave .....        | 3.67            |
| "     | Plympton .....                    | 7.45           | "      | Stewartstown, The Square .....    | 2.94            |
| "     | Crickhowell, Fordlas .....        | 3.20           | "      | Killybegs .....                   | 3.74            |
| "     | New Radnor, Ednol .....           | 3.88           | "      | Horn Head .....                   | 4.41            |

## METEOROLOGICAL NOTES ON NOVEMBER, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

**CAMDEN SQUARE.**—Mild, with practically no frost, but in other respects a normal month, and a typical November. Fog was not extremely frequent, but occasionally very dense, particularly on 20th, when, though the fog did not reach the ground, London was enveloped in absolute darkness for several hours during the morning. Mean temp.  $45^{\circ}6$ , or  $2^{\circ}6$  above the average. Duration of sunshine  $30^{\circ}6$ , and of R  $43^{\circ}6$ , hours.

**CROWBOROUGH.**—R  $1^{\circ}18$  in. below the average of 36 years, raising the deficiency for the year to  $1^{\circ}35$  in. Mean temp.  $44^{\circ}7$ , or  $1^{\circ}5$  above the average.

**TORQUAY.**—Duration of sunshine  $65^{\circ}5$  hours, or  $4^{\circ}0$  below the average. Mean temp.  $48^{\circ}8$ , or  $1^{\circ}2$  above the average.

**NORTH CADBURY.**—Rather wet, with normal temp. and great humidity. A mulberry tree still retained green leaves on December 2nd.

**ROSS.**—Gloomy, with much fog but little frost. The temp. was  $1^{\circ}2$  above the average. On 26th the Wye was in flood.

**BOLTON.**—Remarkably mild till 15th, but afterwards much colder with frequent fogs, especially on 21st and 30th. The duration of sunshine was  $25^{\circ}6$  hours, or  $1^{\circ}8$  above the average. Mean temp.  $43^{\circ}0$ , close to the average.

**SOUTHPORT.**—Calm generally, S.E. and E. airs predominating. Mean temp.  $43^{\circ}7$ , or  $0^{\circ}3$  below the average; the changes from day to day were, however, excessive. Duration of sunshine  $53^{\circ}1$  hours, or  $6^{\circ}0$  above the average, and of R  $70^{\circ}2$  hours. Total R  $^{\circ}50$  in. below the average of 35 years.

**LILBURN.**—Calm, with slight frosts. The outstanding corn was got in before 22nd, when it became rainy till 28th. There was no S except on the Cheviots, which had a slight covering for 10 days.

**HAVERFORDWEST.**—Mild and damp, with considerable R, but no severe storms. Duration of sunshine  $73^{\circ}5$  hours.

**ABERYSTWYTH.**—Heavy and dull, the atmosphere being saturated with moisture. At times there were high and variable winds, with low but equable temp. On 12th there was a hurricane from W., from about 6 p.m. till about 11 a.m. on 13th, accompanied at times by terrific R.

**DOUGLAS.**—Mild, seasonable, and unusually quiet until 25th, with many beautiful days. Severe gale from S.E. on 26th and 27th, and T and L on 27th.

**DUMFRIES.**—Very unsettled. Harvest operations were completed at about the middle of the month, but both grain and straw were seriously damaged.

**INVERARAY.**—There were many pleasant days, and summer lingered as long as possible. Fine and frosty at the close.

**COUPAR ANGUS.**—R  $1^{\circ}05$  in. below the average, reducing the surplus since January 1st to  $2^{\circ}28$  in. Mean temp.  $40^{\circ}0$ , or one degree below the average.

**ABERDEEN.**—Cold and wet and bad for harvest; much of this was still out at the end of the month.

**CASTLETOWN.**—On the whole a fairly good month, the first part being dry and breezy, and enabling farmers to secure corn crops. Harvest was fairly good with abundance of straw, but rather light ear. Potatoes and turnips were average.

**CORK.**—R  $^{\circ}50$  in. above, and temp.  $4^{\circ}5$  below, the average. T and L on 26th.

**DARYNANE.**—Constant but not heavy R, the total being 9 per cent. below the average.

**DUBLIN.**—Opening mild, the month ultimately proved rather cold, the mean temp. being  $44^{\circ}6$ , or  $0^{\circ}7$  below the average of 35 years. Fog occurred on 8 days.

**MARKREE.**—Although dry, the month was one of low temp., with frost and S, sleet and H, on several occasions.

**BANBRIDGE.**—R  $^{\circ}44$  in. below the average of 45 years.

## Climatological Table for the British Empire, June, 1907.

| STATIONS.<br><br>(Those in <i>italics</i> are<br>South of the Equator.) | Absolute. |       |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain |       | Aver.<br>Cloud. |
|-------------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|------------|-------|-----------------|
|                                                                         | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.     | Days. |                 |
|                                                                         | Temp.     | Date. | Temp.    | Date. |          |      |               |           |                 |                   |            |       |                 |
| London, Camden Square                                                   | 78°0      | 9     | 43°9     | 17    | 67°0     | 50°4 | 50°2          | 77        | 123·8           | 39·9              | 2·03       | 19    | ...             |
| Malta ... ..                                                            | 84·2      | 13    | 58·5     | 9     | 75·7     | 63·9 | 58·7          | 68        | 141·0           | ...               | ·00        | 0     | 2·9             |
| Lagos ... ..                                                            | 89·0      | 9     | 71·6     | 6     | 84·7     | 73·7 | 74·2          | 84        | 162·0           | 67·0              | 19·39      | 25    | 7·9             |
| Cape Town ...                                                           | 75·3      | 8     | 38·8     | 6     | 62·1     | 47·1 | 48·3          | 79        | ...             | ...               | 2·01       | 9     | 3·3             |
| Durban, Natal ...                                                       | 83·5      | 24    | 46·3     | 9     | 74·4     | 52·4 | ...           | ...       | 134·4           | ...               | ·34        | 6     | 1·8             |
| Johannesburg ...                                                        | ...       | ...   | ...      | ...   | ...      | ...  | ...           | ...       | ...             | ...               | ...        | ...   | ...             |
| Mauritius ... ..                                                        | 77·3      | 15    | 56·1     | 5     | 74·7     | 62·3 | 61·9          | 80        | 138·0           | 49·0              | 4·17       | 16    | 6·4             |
| Calcutta... ..                                                          | 97·0      | 16    | 71·2     | 3     | 90·9     | 79·1 | 77·7          | 82        | 153·0           | 70·3              | 18·52      | 16    | 7·4             |
| Bombay ... ..                                                           | 93·7      | 10    | 75·4     | 17    | 88·6     | 80·0 | 77·0          | 79        | 139·0           | 72·8              | 22·49      | 20    | 6·7             |
| Madras ... ..                                                           | 107·6     | 1     | 74·9     | 14    | 100·1    | 81·5 | 69·7          | 60        | 148·6           | 73·1              | 2·80       | 9     | 5·6             |
| Kodaikanal ...                                                          | 74·7      | 3     | 50·9     | 17    | 65·5     | 53·6 | 50·6          | 77        | 147·6           | 41·7              | 1·94       | 15    | 6·7             |
| Colombo, Ceylon ...                                                     | 88·2      | 4     | 73·4     | 15    | 86·2     | 77·1 | 74·7          | 82        | 148·6           | 71·0              | 6·45       | 19    | 6·7             |
| Hongkong ... ..                                                         | 89·5      | 19    | 71·8     | 6     | 84·8     | 76·4 | 73·2          | 80        | 138·4           | ...               | 13·17      | 17    | 7·2             |
| Melbourne ... ..                                                        | 72·2      | 1     | 30·2     | 26    | 56·0     | 40·7 | 42·5          | 81        | 122·2           | 23·3              | 1·17       | 7     | 7·1             |
| Adelaide ... ..                                                         | 65·0      | 4     | 34·3     | 27    | 58·9     | 45·5 | 45·7          | 80        | 116·0           | 22·9              | 2·34       | 11    | 6·3             |
| Coolgardie ... ..                                                       | 70·6      | 8     | 34·2     | 15    | 60·9     | 44·2 | 40·7          | 69        | 133·9           | 29·0              | ·35        | 13    | 5·6             |
| Sydney ... ..                                                           | 64·3      | 2     | 42·9     | 29    | 58·9     | 48·9 | 48·2          | 89        | 91·9            | 34·9              | 9·14       | 30    | 7·4             |
| Wellington ... ..                                                       | 58·5      | 30    | 33·0     | 16    | 51·8     | 42·4 | 41·9          | 81        | 93·0            | 26·0              | 4·29       | 14    | 5·9             |
| Auckland ... ..                                                         | 68·0      | 6     | 38·0     | 22    | 58·1     | 46·7 | 44·8          | 75        | 115·0           | 31·0              | 3·61       | 10    | 5·3             |
| Jamaica, Negril Point.                                                  | 88·9      | 30    | 68·2     | 21    | 86·7     | 73·0 | 72·8          | 78        | ...             | ...               | 8·20       | 15    | ...             |
| Trinidad ... ..                                                         | 92·0      | 3     | 67·0     | 7     | 83·8     | 70·8 | 73·3          | 82        | 157·0           | 60·0              | 11·01      | 22    | ...             |
| Grenada ... ..                                                          | 87·2      | 10    | 70·4     | 6     | 83·9     | 74·4 | 70·9          | 77        | 141·0           | ...               | 6·10       | 25    | 5·1             |
| Toronto ... ..                                                          | 86·8      | 18    | 43·9     | 7     | 73·7     | 53·8 | ...           | ...       | 112·3           | 39·1              | 2·12       | 9     | 4·0             |
| Fredericton ... ..                                                      | 91·0      | 13    | 34·0     | 12    | 71·1     | 47·4 | ...           | 70        | ...             | ...               | 2·94       | 9     | 6·0             |
| St. John's, N.B. ...                                                    | 75·9      | 19    | 38·5     | 1     | 62·2     | 47·7 | ...           | ...       | ...             | ...               | 1·60       | 13    | 6·5             |
| Victoria, B.C. ...                                                      | 78·2      | 23    | 43·4     | 2     | ...      | ...  | ...           | ...       | ...             | ...               | ·33        | 5     | ...             |
| Dawson ... ..                                                           | 87·0      | 27    | 31·0     | 4     | 71·9     | 42·5 | ...           | ...       | ...             | ...               | ·85        | 9     | 6·2             |

MALTA.—Mean temp. of air 69°·8. Mean hourly velocity of wind 8·4 miles. Bright sunshine 11·5 hours per day.

LAGOS.—5·08 in. of B fell on the 17th.

MAURITIUS.—Mean temp. of air 0°·2 below, dew point 0°·8, and relative humidity 3·6 per cent. and B 2·12 in. above averages. Mean hourly velocity of wind 2·0 miles below average.

MADRAS.—B 33 per cent. above, temp. above, averages. A dust storm on 10th. L on 6 days; TS on 5 other days.

KODAIKANAL.—Bright sunshine 133 hours.

COLOMBO.—Mean temp. of air 80°·9 or 0°·2 below, of dew point 0°·5 above, and B 1·55 in. below, averages. Mean hourly velocity of wind 9·3 miles.

HONGKONG.—Mean temp. of air 79°·9. Bright sunshine 181·0 hours. Mean hourly velocity of wind 11·6 miles. B 3·63 in. below, and sunshine 30 hours above, averages.

ADELAIDE.—Mean temp. of air 1°·3 below, and B ·65 in. below, averages.

SYDNEY.—Mean temp. of air 0°·5 below, and B 3·72 in. above, averages.

WELLINGTON.—Mean temp. of air 2°·4 below, and B ·71 in. below, averages.

AUCKLAND.—B 1 inch below average. Violent gale 26th—29th, with low barometer.

TRINIDAD.—Rainfall 2·74 in. above 43 years' average.

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## THE RAINFALL OF 1907.

THE rainfall of December has proved to be considerably in excess of the average in all parts of the country, so that the year—which at the end of November promised to be a dry one—has turned out to be one of average rainfall. It is too soon as yet to give a very detailed account of the distribution of rain over the country, but a considerable tract round the estuary of the Thames had less than 20 inches, and the line of 25 inches pursues much the same course on the map as it does on a map of average rainfall. The last column of the Table on p. 245 assumes, this month, the form of a table of ratios of annual rainfall to the average of 30 years, and a map has been constructed from these data, and about 40 supplementary stations which it has been possible to obtain averages. When the figures are set out on this map, it is seen that the whole east coast of Great Britain had less than the average fall of rain, the dry strip widening towards the south, and including the south coast to a point west of Brighton. The extreme fringe of the west of Scotland, the Isle of Man, the Lake District, the coasts of Lancashire, Cheshire and North Wales, the coast of South Wales, and the western horn made up of Cornwall, Devon, Somerset and Dorset, were also drier than in an average year; and the dry belts of the east and west met in a narrow strip through Manchester, Sheffield and Lincoln. In three small areas the rainfall was more than 10 per cent. below the average; these were in North Wales and the Wirral peninsula, along the east coast from the Tees to the Wash, and in the east of Kent; but no station showed a greater deficiency than 13 per cent. The portions of Great Britain where the rainfall exceeded the average included nearly the whole of Scotland, the Pennine region, Wales and the Midlands, with an extension southwards to the coast of Hampshire. Apparently only the parts of Scotland south of Oban and west of Edinburgh had an excess greater than 10 per cent.; and in England, except for a patch in the extreme north-west, there were only a narrow strip in the North Midlands and a spot in Hampshire which were as wet. It is rare to see local differences in the intensity

of rainfall so unobtrusive as in 1907. In Ireland, only a little of the north-east had a rainfall which differed from the average by so much as 10 per cent. The rainfall of the north, of part of the west, and of a patch in the south-east, slightly exceeded the average; in the rest of the country it was slightly less than the average.

The general rainfall for the whole of the British Isles comes out as 1 per cent. above the average, which for all practical purposes may be taken as the average, exactly the same as in 1906. The year 1906 was generally considered to be dry and fine, because the holiday months were dry, and 1907 has generally been stigmatised as wet and wretched, probably because in most parts of the country, as in London, there were a great many days with rain, and, perhaps, because a larger proportion of the rain than is usual fell in the daylight hours. Both years, however, practically coincided with the average, a result that has never previously been recorded. This fact is interesting as illustrating a point on which stress has been laid in these pages and in "British Rainfall" for several years, *viz.*, that the sequence of a wet year following two dry years which has held good for the British Isles since 1889 would sooner or later break down, and could not be relied upon as a basis for prediction. It does not follow that there is not a periodicity in the distribution of annual rainfall; but it seems as if the rhythm were just now changing its time. Expressing the difference from the average in percentages, + for wet years and — for dry years, the sequence taken from the Table on p. 171 of "British Rainfall, 1906," runs:—

|           |           |          |          |           |           |
|-----------|-----------|----------|----------|-----------|-----------|
| 1889 — 10 | 1892 — 5  | 1895 — 7 | 1898 — 2 | 1901 — 11 | 1904 — 9  |
| 1890 — 3  | 1893 — 12 | 1896 — 6 | 1899 — 5 | 1902 — 17 | 1905 — 14 |
| 1891 + 5  | 1894 + 5  | 1897 + 3 | 1900 + 8 | 1903 + 26 | 1906 — 1  |
|           |           |          |          |           | 1907 + 1  |

Splitting up the country into large divisions, adopting the mean of the selected stations in each division as giving its general rainfall (which it is safe to do as the stations are nearly equally spaced), and expressing the average by 100 in each case, the result is—

*General Rainfall in 1907. Average = 100.*

| England | Wales | Scotland. | Ireland. | BRITISH ISLES. |
|---------|-------|-----------|----------|----------------|
| 98      | 101   | 106       | 102      | 101            |

The monthly incidence of rain is always interesting, for in farming, water-supply, and in all pursuits where rainfall is a determining factor, the way in which the rain falls and the time at which it comes are often more important than the total amount. The table which follows shows concisely how the rainfall of the months varied from their average in the great divisions of the United Kingdom. It is a summary of the monthly percentage column of the detailed tables published regularly in this Magazine:—

|               | England & Wales. | Scotland. | Ireland.  | BRITISH ISLES. |
|---------------|------------------|-----------|-----------|----------------|
|               | per cent.        | per cent. | per cent. | per cent.      |
| January ..... | 55               | 74        | 48        | 58             |
| February ...  | 78               | 98        | 85        | 84             |
| March.....    | 71               | 115       | 115       | 91             |
| April .....   | 147              | 118       | 130       | 137            |
| May .....     | 150              | 160       | 158       | 154            |
| June .....    | 133              | 181       | 156       | 149            |
| July .....    | 77               | 73        | 85        | 78             |
| August .....  | 82               | 125       | 90        | 94             |
| September...  | 25               | 37        | 42        | 32             |
| October ..... | 154              | 129       | 138       | 145            |
| November ...  | 86               | 85        | 98        | 88             |
| December ...  | 134              | 109       | 117       | 125            |
| YEAR .....    | 99               | 106       | 102       | 101            |

Taking the British Isles together, five months of 1907 were wet and seven dry as compared with the average, and the most prominent features of the year were the very wet three months of spring and early summer and the extremely dry September.

### METEOROLOGICAL SERVICE IN JAMAICA.

WE learn from Mr. Maxwell Hall that the colonial meteorological service in Jamaica, which has been in abeyance since 1899, has been re-established, and that he has again taken charge of it. We heartily congratulate the Government of Jamaica on this happy event, for although the generosity of the United States Weather Bureau maintained a complete observing station in Kingston from 1898 to 1903, and a less fully equipped station down to date, the recording of local weather is a duty which no government ought to neglect. We gladly quote from the interesting article in the *U.S. Monthly Weather Review* for July, 1907, by Mr. D. T. Maring, who represented the U.S. Weather Bureau at Kingston after the earthquake in January, 1907, the following message from Sir Sydney Olivier, the Governor, to the Legislative Council of Jamaica :—

#### HONOURABLE GENTLEMEN,

I have the honour to inform you that I have received a resolution passed by the Jamaica Agricultural Society at their last half-yearly general meeting, inviting the attention of the Government to the need for restoration of the meteorological service in this Island. I have consulted my Privy Council on this subject, and they agree with me in thinking that the time has come when this service should be restored. The meteorological service, which had existed since the year 1880, was, from the urgent necessity for economy, practically abolished in the year 1899, when it was reduced to the compilation of rainfall statistics; and the total abolition of any separate



vote for this latter kind of work occurred in the year 1902, when such work was allotted to the staff of the Island Chemist.

The restoration of the service as it existed for many years would enable us again to have a useful local system of storm warnings, together with complete meteorological returns for the capital of this Island, which, for some years, has had to do without them. It would also enable a revision to be made of the rainfall maps of the Island which were prepared some years ago after twenty years' registration, but which should now be compiled on the results of some forty years' registration. The scheme now proposed would also include a modest time service, whereby the correct time could be notified throughout the Island from the Island telegraph office in Kingston. Other work of a miscellaneous and useful character would from time to time be performed. The chief reason, however, which impels me to suggest to you at this particular time the desirability of the restoration of the weather service is the first one set out above, viz., that we should have an effective system of local storm warnings. At the time of the abolition of the old service, the Island was fortunate in having had recently established in its midst a well-equipped station with a resident staff supported by the United States Government, and the Island benefited by the generosity of that Government. Since then that service has been reduced and the staff withdrawn, and in the public interest a local system of storm warnings seems necessary. The value of such a system is of two kinds—one positive, the issuing of notices of approaching cyclones, and the other negative, the issuing of notices to dispel false alarms. It has been represented to me that on the occasion of the last cyclone in August, 1903, one firm alone in a seaport town of Jamaica lost in the value of lighters about four times the annual cost of the weather service, which it is stated would have been saved if the old weather service with its system of telegraphic warnings throughout the Island had then been in existence. Doubtless there are other instances of a like nature within the memory of honourable gentlemen. The dispelling of false alarms is also of great value, and is often the means of saving money which would otherwise be needlessly expended.

A resolution will therefore be submitted to you inviting you to vote a sum at the rate of £150 a year for the restoration of the Island Weather Service.

SYDNEY OLIVIER, *Governor.*

*King's House, 27th June, 1907.*

The service has been re-established at the modest expense of £150 per annum, and the U.S. Weather Bureau has presented the instruments belonging to them and arranged for the mutual exchange of storm warnings, for which in the hurricane season Jamaica is a most valuable centre.

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### ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, December 13th, at the Institution of Civil Engineers, Great George Street, Westminster, Dr. H. R. Mill, President, in the chair.

Captain C. H. Ley read a paper on "The possibility of a Topography of the Air, based on Balloon observations with special Theodolites." The author gave the results of his own observations in Herefordshire, in connection with the International balloon ascents which were carried out during the past summer. His method of observing is based on the direct estimation of the range of the balloon from its apparent diameter, as measured by cross threads in a telescope; the range being thus determined, an altitude and azimuth are read, and the position of the balloon fixed and plotted on a map. As a rule, over a hill both the vertical and horizontal velocity increase, but the vertical velocity in greater proportion than the horizontal. On the other hand, over the lower ground, before and after a hill, it appears that a horizontal velocity usually increases faster, or shows a less decrease, than the vertical velocity, especially at the greater heights. The horizontal deflection of the wind, due to the ground, is much more marked when there is less wind, as in anti-cyclonic conditions, in cyclonic calms, and at low altitudes. In such conditions the general tendency seems to be for the breezes to blow as far as possible along the contours of the ground. In the case of a valley, the line of least resistance is found along the bottom of the valley; and in the case of a ridge this line is along the contours; and a breeze sometimes appears along and below the farther edge of the ridge, in a direction indicative of the general direction of the superimposed current. Horizontal deflection is often accompanied by a collapse of vertical velocity. The author, in conclusion, says the varying topography of the Earth's surface produces disturbances in the atmosphere with effects which are transmitted throughout the lower and middle strata; and that the general effect on a current is to increase its velocity over a hill and decrease it over a valley, and this is especially the case with the vertical velocity. The origin of the phenomena is to be sought in the mechanical effect of obstruction of the lowest stratum, but there are probably various ensuing complications which may accentuate the result. The measurement of these effects can be carried out by a topography of the air made in any locality.

Mr. W. W. Bryant, Mr. C. J. P. Cave, Capt. A. Carpenter, Dr. W. N. Shaw, Mr. E. S. Bruce, Mr. W. Marriott, and the President, took part in the discussion, and Capt. Ley replied.

Mr. R. Strachan also read a paper on "Indications of approaching frost," in which he said that for the purpose of making forecasts the dry and wet bulb thermometers should be noted at or after sunset, or at 9 p.m., and the amount of cloud at the time, and during the forepart of the night, if convenient. The dew-point can be found by reference to hygrometrical tables. When the dew point is at or below  $32^{\circ}$  frost is in evidence, but may be evanescent, due to a rise of temperature, with a change of wind, rain, or overcast sky. Even when it is above  $32^{\circ}$ , if the sky is clear it is possible that the temperature on the ground will go low enough for frost to

form. Thus the evening observations should lead to a good idea of what may happen during the night.

The following ladies and gentlemen were elected Fellows of the Society :—Mr. C. A. Allen, Mr. E. Heron Allen, Mr. A. Bailey, Mr. H. J. Bailey, Major W. Alcock Beck, Mr. C. H. Berners, Mr. C. Brown, Miss L. H. Bushell, Mr. C. P. Chambers, Mr. H. R. G. Clarke, Mr. A. Clay, Mr. H. B. Devereux, Mr. T. A. Dickson, Mr. J. Dixon, Mr. J. W. Duncan, Rev. J. C. Fox, Mr. E. Pirie Gordon, Mr. W. Hall, Mrs. Marcus Hare, Mr. J. Hawksley, Assoc. M.Inst. C.E., Mr. A. P. Jenkin, Mr. C. E. Jones, Assoc. M.Inst. C.E., Mr. Owen Jones, Mr. F. D. Kapadia, Mr. L. G. King, Miss I. J. R. Macadam, Mr. W. G. Machin, Mr. P. P. Pennant, Mr. J. E. Petavel, F.R.S., Miss F. Sparks, Mr. A. J. Stephens, Mr. W. S. Strachan, B. Sc., Capt. F. S. Symons, Mr. A. J. Walker, M.A., Mrs. M. Wilkin, Miss E. D. Woodhouse, and Miss J. L. Woodward.

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## THE CHRISTMAS SNOWSTORM OF 1906 IN EASTERN EUROPE.

"DAS WETTER" for February, 1907, contains a short article by Herr E. G. Edler with reference to snowfall and other meteorological conditions in Bohemia during the last week of 1906. During the night of December 26th snow fell at Wahlburg to the depth of six inches, accompanied by high wind, causing deep drifts. The snow-storm accompanied a barometrie pressure of 28.9 inches, unusually low for Central Europe.

On the 30th more snow fell, and during the ensuing night the temperature fell to 8° F., the sky being clear and the wind south-west, of Beaufort force 3. The storm of the 26th night was due to a small depression with steep pressure gradients over Bohemia, in some way subsidiary to a large and deep one centred over Scandinavia. It is quite likely that this small depression was identical with the deep one which moved south-eastwards across England on the night of December 25th, bringing with it so much deep snow. The enormous quantities of snow that fell in the east of Scotland between the 26th and 27th appear to have been occasioned by small secondary disturbances in connection with the large cyclonic system centred over Scandinavia. It may be noted, as a matter of interest, that Bohemia lies practically within the East-European region of perpetual winter snow, not like England in the West-European region of intermittently snow-covered ground.

L. C. W. B.

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

## THE GREEN FLASH.

MY residence at Montego Bay, Jamaica, faced the west, and at an elevation of 160 feet above sea-level it overlooked the bay. The sea horizon was as a rule wonderfully clear and well defined, so much so that stars of the first magnitude, with the aid of a field glass, could be seen to set, or rather to disappear instantly as in occultation.

After the spring equinox last year the sun could be seen to set below the sea horizon, and all the members of my family began to look out for the green flash. The first attempt was a failure; the bright red limb of the setting sun was so strong that we all saw green wherever else we looked, and our sight was dimmed at the critical moment.

Next evening we each had a card in which a pin-hole had been made, and what we saw that evening we could always see again during the three weeks the observations were continued.

Looking through the pin-hole, as the limb of the sun was about to disappear, it was seen to form a short, thin red line; suddenly this line was transformed into a bright red star, which remained red for about three seconds; then the colour suddenly changed from red to green, and remained so for about half a second, when it suddenly vanished.

Children and all saw the change of colour at the same instant of time; the cry of "There!" was simultaneous.

I was not able to go on with magnifying power and dark glasses simply because I was transferred from Montego Bay to Chapelton; and it appears that it would have been quite unnecessary, as Dr. Rambaut has done all that is required.

The effect is certainly due to the dispersion of the atmosphere, as Dr. Rambaut has explained in these pages last year; and my trivial device may be a source of amusement to many who have a clear sea horizon to the west.

MAXWELL HALL,

*Jamaica, Dec. 11th, 1907.*

*Govt. Meteorologist.*

## NOTES ON 1907.

THE wettest day in each of the twelve months of 1907 occurred at Upton as follows:—

|       |       |       |                 |           |
|-------|-------|-------|-----------------|-----------|
| 1st,  | 1st,  | 2nd,  | 2nd.....        | of month. |
| 11th, | 11th, | 12th, | 12th, 14th..... | „         |
| 21st  | ..... | ..... | .....           | „         |
| 25th, | 26th  | ..... | .....           | „         |

(but not in the *sequence* given above). It will be noticed that on

four occasions the 1st—2nd of month occur, and on five occasions the 11th—14th.

Another feature of 1907 may be noted, the equability of temperature during the year. The highest was  $78\frac{1}{2}^{\circ}$  F. and the lowest was  $21\frac{1}{4}^{\circ}$  in the screen. Days over  $80^{\circ}$  F. in the nine previous years (here) were, beginning with 1898: 19, 31, 23, 19, 9, 6, 14, 14, 21. Next comes the year 1907, *nil*.

The extraordinary mildness of December last will doubtless be referred to by other contributors.

RICHARD BENTLEY.

*Upton, Slough, Bucks.*

### WANTED! A NAME.

IN regard to "A.B.M.'s" letter I need hardly say that it is extremely difficult to change a name grown familiar by long usage. It is also, in some respects, inexpedient, though the name may not be appropriately expressive. I am afraid that however desirable it may seem, "meteorology" will long continue to represent the "science of the weather."

Even if a suitable substitute were found its general acceptance could not be ensured, and it would probably soon be dropped to revert to the older designation. In any case to alter a long-standing appellation would obviously cause confusion, besides bringing about more trouble and misunderstanding than the change was intended to avoid.

Various misnomers or badly-applied names could be quoted in several departments of science or as given to phenomena which they do not correctly express or imply. Thus in astronomy an "eclipse of the sun" is properly an "occultation of the sun," as the word eclipse is usually applied to an event where one celestial body is obscured by passing through the shadow of another, or during a lunar eclipse when the moon travels through the Earth's shadow. But there is little likelihood that the term "eclipse of the sun" will ever be put aside for one considered more applicable, for the ancient title is well understood if it is not accurate in a technical sense.

I am not an advocate for the retention in perpetuity of any inapt titles or misnomers where substantial reason can be assigned for change, but I think that in general it is best to preserve old names, for

"Time doth consecrate,  
And what is grey with age becomes religion."

W. F. DENNING.

### "SHADE" TEMPERATURE.

I RECENTLY had occasion to make a comparison of the maximum and minimum temperatures registered in (A) a verandah facing north, and (B) a Stevenson screen. The thermometers were by the best

makers, with Kew certificates, and were carefully compared by being hung side by side in the verandah on a wooden trellis five inches distant from the wall. The maxima were recorded continuously from September 15th to October 6th, and gave the means :

A .. ... 63°·6      B ..... 65°·7

The greatest differences were on

Sept. 24th ..... A ..... 65°·2      B ..... 69°·4  
 „ 25th ..... A ..... 70°·0      B ..... 74°·0

On one occasion only was A higher than B, viz., September 29th, when A was 60°·5 and B 60°·2.

The minima from September 19th to October 8th gave means :

A ..... 51°·7      B ..... 50°·7

The greatest difference was on October 5th :

A ..... 44°·0      B ..... 42°·1

B was never as high as A.

To summarize : the temperature in a verandah facing north and shielded from lateral sunshine is about 2° lower in the daytime and 1° higher at night. The latter is perhaps due to radiation from the wall of the house.

ALFRED O. WALKER.

*Ulcombe Place, nr. Maidstone, Dec. 22nd, 1907.*

## THE GREENWICH OBSERVATIONS.

A CORRESPONDENT points out that the notice of the last annual report of the meteorological work at the Royal Observatory at Greenwich, on p. 219, contained some expressions that might give rise to misconceptions in the minds of some readers, and, while experience has convinced us that no form of words can be devised which can altogether exclude the possibility of misconception, we are always ready to try to correct any wrong ideas that may be suggested, however unwittingly, by anything which appears in these pages.

Our correspondent says that the reference to the different hours of observations on Sundays seems to him to give the impression that the Sunday results are less reliable than those of other days, which he says is not the case. The daily results for all days, as regards pressure and wet and dry bulb temperatures, are based on 24 hourly measurements of the photographic trace of the recording instruments, the eye observations being used simply to reduce the photographic records to the values of the standard instruments. The maximum and minimum temperatures are given for all days, Sundays included; and the omission of the Sunday observations at certain hours of the day in the case of the subsidiary thermometers in various positions is no great loss, as the weekday observations suffice to show the sort of variation that exists in the daily differences.

We understand that a deep-rimmed rain gauge, of the Meteor-

ological Office pattern, is being added to the existing rain gauges at the Royal Observatory for comparison with them

We find on reference to the volume of Hourly Observations at the Observatories under the Meteorological Office, noticed on p. 219, that we, and not the Stationery Office, made a mistake, as there are 12 monthly parts at 6d. for each of the four Observatories, and not merely 12 monthly parts as we had rashly assumed.

## REVIEWS.

*Air Currents and the Laws of Ventilation. Lectures on the Physics of the Ventilation of Buildings, delivered in the University of Cambridge, in the Lent Term, 1903.* By W. N. SHAW, Sc.D., F.R.S., Honorary Fellow of Emmanuel College; Director of the Meteorological Office Cambridge, at the University Press, 1907. Size  $8\frac{1}{2} \times 5\frac{1}{2}$ . Pp. xii.+94.

THIS little book abounds in novelty of presentation, the most striking instance being the way in which the author works out the theory of ventilation on the analogy of electricity, and so assigns quantitative values to the movement of air in buildings with relation to the size of orifices and the strength of currents. The book is thus of great scientific and practical interest. Dr. Shaw says that it is, in a way, his last will and testament in respect of ventilation, for "the requirements of the study of the processes of ventilation on the larger scale, as they are exhibited in the weather, no longer permit me to work out these interesting, but complicated problems."

*Handbuch der Ozeanographie von DR. OTTO KRÜMMEL. Band I. Die räumlichen, chemischen und physikalischen Verhältnisse des Meeres.* [Handbook of Oceanography by Dr. Otto Krümmel. Vol. I. The dimensional, chemical and physical conditions of the Sea.] Stuttgart: Engelhorn, 1907. Size  $9 \times 6$ . Pp. xvi. + 526. Price 22 marks.

PROFESSOR KRÜMMEL, who fills the Chair of Geography in the University of Kiel, and has been for many years the leading German exponent of oceanography, has produced what is nominally a new edition of the first volume of the Handbook of Oceanography, written some years ago by Professor G. von Boguslawski and himself, but really it is a new work, entirely re-written and based upon the accumulated records of oceanographical research down to the latest date. While the whole question of the physics of the ocean lies close to that of the physics of the atmosphere, and no part of the science of the sea can be held alien by the student of the air, the part of this book which most directly concerns us in this place is

the short section on the relations between air and water temperature, a matter to which Professor Krümmel has given particular attention. He shows that the surface of the sea is in general warmer than the overlying air, and to such an extent is this the case in winter, that the warm Atlantic water entering the Baltic on a cold day often steams so strongly that the columns of condensed vapour resemble waterspouts, and give rise to showers of powdery snow. Over cold currents, however, the air may remain warmer than the water for many months together. Professor Krümmel deals with the whole of his wide subject with a firm hand, and in an interesting style.

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*Note on the Connection between Rainfall at Durban and Mauritius.* By T. F. CLAXTON, F.R.A.S. Reprint from *Trans. South African Philosophical Society*, Vol. 16, Pt. 5. June, 1907. Size, 10 × 6½. Pp. 6.

MR. T. F. CLAXTON, as the first results of an inquiry into the possibility of drawing up seasonal weather forecasts for the island of Mauritius, shows by a comparison of observations made at Durban with those at ten stations scattered over the island of Mauritius during the years 1873–1904, that winter droughts at Durban have invariably been followed by summer droughts in Mauritius; also that prolonged droughts in Natal, or those commencing in summer, have been either accompanied or followed by prolonged droughts in Mauritius. The interval between the winter droughts at Durban and the summer droughts at Mauritius is from three to seven months, and appears to depend on the time of commencement of the former. No relation, however, is apparent between the interval, duration and intensity of the Mauritius summer droughts with the duration and intensity of the Natal winter ones. Mr. Claxton regrets that he was unable to avail himself of observations from other places in Natal besides Durban. A point of interest noted by him, is that the Durban winter droughts are not necessarily followed by an absence in summer of cyclones in the neighbourhood of Mauritius, and that the summer droughts of Mauritius are related to the non-cyclonic type of rainfall.

L.C.W.B.

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*The Science Year Book and Diary for 1908.* (Fourth year of issue.) Edited by MAJOR B. F. S. BADEN-POWELL. London: King, Sell and Olding. Size, 9 × 5.

THIS convenient and useful combination of book of reference and diary continues to improve with each successive issue. The Editor asks for suggestions for further improvement, and we agree with his own suggestion in the preface, that more detailed summaries of the scientific progress of the previous year would be a welcome addition.

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*Report of Committee appointed to enquire whether earlier warning of the Typhoon of September 18th, 1906, could have been given to shipping, Hongkong, 1906. Size, 13½ x 9. Pp. 60.*

REFERENCE was made to the appointment of this Committee in the Magazine for October, 1906 (Vol. 41, p. 171), and we are happy now to give the substance of the report as submitted to Sir Matthew Nathan, Governor of Hongkong, by the Committee consisting of Sir Henry S. Berkeley, K.C., Lieut. H. Butterworth, R.N., Mr. A. B. Skottowe of the Eastern Extension Telegraph Company, and Captain A. Sommerville.

The Committee met on the 24th of September, 1906, as well as on several subsequent occasions; although not invested with power to compel the attendance of witnesses, it invited ship-masters and others likely to possess information to assist in the enquiry. The evidence taken by the Committee is appended to the report. The Shanghai Observatory on the 18th, after the storm published the following:—“A very violent storm of quite limited area raged in Hongkong on Tuesday morning” (18th). At 8 a.m. on the 18th an order to hoist the Black Drum was issued from the Hongkong Observatory, indicating the existence of a typhoon at a distance within 300 miles from the colony. The Committee were of opinion that the barometric observations noted in the report did not call for the hoisting of any typhoon signal in Hongkong on the 17th of September. Evidence as to the general appearance of the weather on the morning of the 18th, prior to the hoisting of the Black Drum, was conflicting. Summing up the whole evidence, the Committee found that before 7.44 a.m. on the 18th there were no signs of the approach to Hongkong of a typhoon; and that warning, by the hoisting of the Black Drum, was given as soon as was practically possible.

From the evidence annexed to the report, it appears that the area of the storm was small. Thus, while at 10 a.m. the storm at Hongkong had reached its greatest fury with a south-west wind of force 11, at Macao, about 36 miles away, the wind was north of force 1. Captain Hooker, of the China Navigation Company's s.s. “Kwei Chow,” recorded by his typhoon barometer a decrease of pressure out at sea amounting to an inch in an hour and a half.

The pressure chart for 6 a.m., September 18th, 1906, issued by the Zi-Ka-Wei Observatory of the China Weather Service, shows that an anticyclonic area lay to the north of China, and that a low-pressure area favourable for typhoon development embraced the neighbourhood of Hongkong.

The typhoon, it will be remembered, was a disastrous one, and the following meteorological observations recorded at Hongkong Observatory while it was raging on the morning of the 18th may be of interest:—

| Hours.   | Barometer<br>reduced to<br>sea level. | Temp.    | Wind.      |        | Clouds.          |
|----------|---------------------------------------|----------|------------|--------|------------------|
|          |                                       |          | Direction. | Force. |                  |
| 7 a.m... | 29.698 in.                            | 77°·3 F. | N.W.       | 3      | 10 nimbus N.N.W. |
| 8 „ ...  | 604 „                                 | 76°·8 „  | N.W.       | 5      | —                |
| 9 „ ...  | 394 „                                 | —        | W. by N.   | 10     | —                |
| 10 „ ... | 275 „                                 | 75°·0 „  | S.W.       | 10-11  | 10 nimbus.       |
| 11 „ ... | 633 „                                 | —        | S.         | 6      | —                |
| 12 „ ... | 703 „                                 | 77°·1 „  | S.S.W.     | 4-7    | 10 nimbus S.S.W. |
| 1 p.m... | 767 „                                 | 78°·6 „  | S.         | 3      | —                |

L. C. W. B.

*Discussion of the Errors of certain types of Minimum Spirit Thermometers in use at the Royal Alfred Observatory, Mauritius.* By B. A. WALTER, F.R.A.S., Chief Assistant. From *Trans. S. African Phil. Soc.*, 16 (1907), Part 5). Size, 10 × 6½. Pp. 18.

DESCRIPTION of an elaborate series of experiments devised to account for the discrepancies observed between the minimum as recorded by a photographic thermograph and an ordinary minimum thermometer. The practical conclusion arrived at by Mr. Walter is that no spirit thermometer with a spherical bulb should be allowed in the equipment of a meteorological observatory, as by reason of their sluggishness such thermometers always give too high a minimum, sometimes by as much as 3° F. We entirely concur in this conclusion; our own observations with different patterns of spirit thermometers leading us to view the spherical-bulb instrument as practically useless, at least as a minimum on grass.

*Report of the Chief of the Weather Bureau for 1907, by WILLIS L. MOORE, U.S. Department of Agriculture.* Washington, 1907. Size, 9 × 6. Pp. 56.

AN official report commencing "Americans take pride," shows that the work being reported on is going forward with confidence and a light heart. They take pride, it goes on to say, "in the pioneer work that Lieutenant Maury, the naval meteorologist, did," and that pioneer work is being continued with an energy and enthusiasm that are altogether admirable. American meteorologists are proud of their past, and not so much hopeful as certain of their future. What European official would write in such a strain as follows?

"A research observatory has been created at Mount Weather, Va., and a staff of highly trained and ambitious young men has been

formed. The first important result achieved by this staff was the sending of meteorological instruments by means of aeroplanes to greater altitudes than has to our knowledge been accomplished elsewhere. The observations thus obtained have been continued for over three months in succession, practically without interruption, and it is probable that such record will be maintained indefinitely in the future."

On October 3rd, 1907, observations were made by means of aeroplane at 23,111 feet above sea level, and "the world's record for the securing of observations high in the air was broken." Free balloons with meteorographs are to be used in large numbers for the purpose of exploring the atmosphere up to 10 miles, and a strong effort is being made to apply upper air results in forecasting weather.

All the other departments of the work, special investigations of evaporation of the Salton Lake, radiation experiments, wireless telegraphy, teaching of meteorology and the like, are dealt with in the same spirit, and this healthy and optimistic report winds up with "Increase in Salaries."

*Ceylon. Administration Reports, 1906. Part IV. Education, Science and Art; Meteorology. Report of the Surveyor-General. Size 13 x 8. Pp. 52. Plates.*

A FULL account of the meteorological observations in Ceylon during 1906, illustrated by diagrams, rainfall maps of the months and of the year, the latter indicating the direction and force of the wind, and with an interesting plate showing tea-leaves bruised and perforated by hail.

## METEOROLOGICAL NEWS AND NOTES.

THE PORTRAIT OF DR. ALEXANDER BUCHAN which, by the kindness of Mr. John Thomson, we are enabled to reproduce as a frontispiece to this volume, is a very faithful presentment of the striking personality of the distinguished meteorologist, a sketch of whose career will be found on pp. 103-106.

DR. H. R. MILL is to give a course of six lectures on the Geographical Distribution of Rainfall in the British Isles, under the auspices of the Royal Geographical Society, at the Theatre, Burlington Gardens, on Thursdays, at 6 p.m., commencing on January 23rd and continuing weekly. Full particulars may be obtained on application to the Chief Clerk, Royal Geographical Society, 1, Savile Row, London, W.

MR. GOLD, THE LECTURER ON METEOROLOGY in the University of Cambridge, begins a course of eight lectures in the Cavendish Laboratory on January 16th. Lectures I. to IV. will deal with the Thermo-dynamics of the Atmosphere, and Lectures V. to VIII. with

**Atmospheric Motion.** The syllabus of the course promises well for original handling of data which have not yet become the common-places of text-books.

THE STUDY OF WEATHER AS A BRANCH OF NATURE KNOWLEDGE is treated in an admirable article by Miss Marion Newbigin, D.Sc., in the *Scottish Geographical Magazine* for December, 1907, being a lecture which she had delivered to teachers in Aberdeen and in Edinburgh. She strongly commends meteorology as a branch of Nature study in schools.

AVAILABLE DAYLIGHT may be measured by the number of hours between sunrise and sunset during which we are awake and about. The proverbial healthiness and wisdom of "early to bed and early to rise" depend on the increase of the available daylight, and an ingenious plan to enable everyone to find these boons unconsciously has been put forward by Mr. Wm. Willett. It consists in a compulsory putting back of all official clocks, so as to make the nominal day begin earlier in the summer months, so that the world will go to work soon after sunrise and leave a large surplus of daylight for enjoyment after work hours. The suggestion is admirable, and would work perfectly under an ideal despotism; but, except at sea, where it is the order of the day in order to keep the meridians straight, we fear the inherent conservatism of the British people would never sanction so revolutionary a proceeding. From the point of view of scientific work, of course the displacement of 12 o'clock from mean noon could not be contemplated, but if a neatly-phrased alternative system of time-keeping could be arrived at we should greatly enjoy the 210 extra hours of sunshine, or at least of daylight, in the waking year.

THE INTERIOR OF THE EARTH MAY INFLUENCE CLIMATE in the opinion of Prof. John Milne, who in his report on Seismology to the Leicester meeting of the British Association, pointed out that there was evidence in the luminous appearance sometimes seen on cliffs or quarry walls of radio-active or electric emanations from the solid substance of the Earth, and, if such exist, it is very unlikely that they do not affect the climate. At present the supposed effect is purely hypothetical, and there is no foundation for the positive statements in some newspapers that weather is made in the Earth's crust.

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Erratum.—Our attention has been called to a stupid blunder in the heading of the Climatological Table for the British Empire, on the last page of each number of this Magazine, from April to October, 1907, where the column of "Absolute" extremes refers to "Max. on grass," in place of "Min. on grass." The obviousness of the blunder makes it the less harmful, but how it should have been passed so long in proof-reading is one of the problems that puzzle an Editor.

TEMPERATURE FOR DECEMBER, 1907.

STATION.	COUNTY.	Lat. N.	Long. W. [°E.]	Height above Sea. ft.	TEMPERATURE.				No. of Nights at or below 32°	
					Max.		Min.		Shade.	Gross.
					°	Date.	°	Date.		
Camden Square.....	London.....	51 32	0 8	111	57·0	8	29·9	16	2	12
Tenterden.....	Kent.....	51 4	*0 41	190	58·0	8	30·0	16	7	15
West Dean.....	Hampshire.....	51 3	1 38	137	56·0	8	28·0	6	10	18
Hartley Wintney.....	".....	51 18	0 53	222	55·0	8, 9, 10	28·0	6, 7	10	19
Hitchin.....	Hertfordshire.....	51 57	0 17	238	56·0	8	28·0	15||	...	13
Winslow (Addington).....	Buckinghamsh. r.	51 58	0 53	309	54·0	8	28·0	30	13	17
Bury St. Edmunds (Westley).....	Suffolk.....	52 15	*0 40	226	55·0	8	26·0	24	16	...
Brundall.....	Norfolk.....	52 37	*1 26	66	56·4	8	26·2	16	8	22
Winterbourne Steepleton.....	Dorset.....	50 42	2 31	316	54·4	8	29·3	6	7	11
Torquay (Cary Green).....	Devon.....	50 28	3 32	12	57·2	8	33·5	29	0	3
Polapit Tamar (Launceston).....	".....	50 40	4 22	315	56·0	8	28·2	30	4	12
Bath.....	Somerset.....	51 23	2 21	67	57·0	8	29·0	6, 30	8	...
Stroud (Upfield).....	Gloucestershire.....	51 44	2 13	226	51·0	8	27·0	28, 29	10	...
Church Stretton (Wolstaston).....	Shropshire.....	52 35	2 48	800	52·5	8	24·0	29	15	...
Coventry (Kingswood).....	Warwickshire.....	52 24	1 30	340	47·0	19	31·0	28, 30	3	...
Boston.....	Lincolnshire.....	52 58	0 1	25	52·0	8	29·0	16	12	...
Worksop (Hodsock Priory).....	Nottinghamshire.....	53 22	1 5	56	55·0	8	25·4	24	11	25
Derby (Midland Railway).....	Derbyshire.....	52 55	1 28	156	54·0	8, 20	26·0	30	13	...
Bolton (Queen's Park).....	Lancashire.....	53 35	2 28	390	51·7	8	29·6	1	9	19
Wetherby (Ribston Hall).....	Yorkshire, W. R.	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage.....	".....	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park).....	" E. R.	53 45	0 20	6	54·0	8	25·0	24	5	19
Newcastle (Town Moor).....	Northumberland.....	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite).....	Cumberland.....	54 30	3 10	423	52·5	7	28·4	15	7	...
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street).....	Pembroke.....	51 48	4 58	95	54·5	9	26·7	29	7	10
Aberystwyth (Gogerddan).....	Cardigan.....	52 26	4 1	83	54·0	20, 21	20·0	28	...	...
Llandudno.....	Carnarvon.....	53 20	3 50	72	55·0	4	32·2	27	0	...
Cargen (Dumfries).....	Kirkcudbright.....	55 2	3 37	80	52·0	19	24·0	1	10	...
Lilliesleaf (Riddell House).....	Roxburgh.....	55 31	2 46	550	...	...	...	...	...	...
Edinburgh (Royal Observy.).....	Midlothian.....	55 55	3 11	442	48·8	8, 22	30·1	30	7	15
Girvan (Pinmore).....	Ayr.....	55 10	4 49	207	50·0	7†	23·0	15	12	12
Glasgow (Queen's Park).....	Renfrew.....	55 53	4 18	144	50·0	19	25·0	1	6	26
Tighnabruaich.....	Argyll.....	55 55	5 14	50	44·0	18	27·0	14	16	17
Mull (Quinish).....	".....	56 36	6 13	35	52·0	13	...	...	...	...
Dundee (Eastern Necropolis).....	Forfar.....	56 28	2 57	199	47·5	17	26·0	1	9	...
Braemar.....	Aberdeen.....	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford).....	".....	57 8	2 7	120	48·0	2‡	24·0	29	14	...
Cawdor.....	Nairn.....	57 31	3 57	250	...	...	...	...	...	...
Invergarry.....	E. Inverness.....	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph).....	W. Ross.....	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	50·5	17	28·5	30	11	...
Castletown.....	Caithness.....	58 35	3 23	100	50·0	17	27·0	8‡	22	24
Killarney (District Asylum).....	Kerry.....	52 4	9 31	178	56·0	8	29·5	29	...	...
Waterford (Brook Lodge).....	Waterford.....	52 15	7 7	104	53·0	16	27·0	6	7	...
Broadford (Hurdlestown).....	Clare.....	52 48	8 38	167	48·0	16, 19	28·0	6†	13	...
Abbey Leix (Blandsfort).....	Queen's County.....	52 56	7 17	532	53·0	19	23·0	5**	...	13
Dublin (Fitz William Square).....	Dublin.....	53 21	6 14	54	54·8	20	31·0	15	1	9
Ballinasloe.....	Galway.....	53 20	8 15	160	53·0	7	23·0	24	21	...
Clifden (Kylemore House).....	".....	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe).....	Mayo.....	54 4	9 18	74	...	...	...	...	...	...
Seaford.....	Down.....	54 19	5 50	180	52·0	7	28·0	6†	10	16
Londonderry (Creggan Res.).....	Londonderry.....	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel).....	Tyrrone.....	54 36	7 18	280	...	...	...	...	...	...

† and 19, 20. ‡ and 17, 22. || and 23, 24. † and 30, 31. ¶ and 28, 31. ** and 22, 28. †† and 14, 24.

RAINFALL FOR DECEMBER, 1907.

RAINFALL OF MONTH.						RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
Aver. 1870-99.	1907.	Diff. from Av.	% of Av.	Max. in 24 hours.	No. of Days	Aver. 1870-99.	1907.	Diff. from Aver.	% of Av.		
in.	in.	in.		in.	Date.	in.	in.	in.		in.	
2.12	3.79	+1.67	178	.72	12	16	25.16	23.01	- 2.15	91	Camden Square
2.74	2.78	+ .04	101	.47	13	16	28.36	24.86	- 3.50	88	Tenterden
2.74	4.32	+1.58	158	.95	2	20	29.93	29.28	- .65	98	West Dean
2.55	3.68	+1.13	144	.70	11	17	27.10	27.46	+ .36	101	Hartley Wintney
2.05	3.28	+1.21	159	.85	4	14	24.66	24.51	- .15	99	Hitchin
2.27	3.79	+1.52	167	.79	4	21	26.75	25.54	- 1.21	95	Addington
2.11	3.05	+ .94	144	.64	13	16	25.39	24.78	- .61	98	Westley
2.13	2.60	+ .47	122	.64	13	20	25.40	25.41	+ .01	100	Brundall
4.13	5.53	+1.40	134	.82	11	26	39.00	39.27	+ .27	101	Winterbourne Stptin
3.46	4.37	+ .91	128	.65	2	28	35.00	33.22	- 1.78	95	Torquay
4.39	6.48	+2.09	148	1.33	4	25	38.85	38.14	- .71	98	Polapit Tamar
2.76	4.80	+2.04	174	1.04	4	21	30.75	32.33	+ 1.58	105	Bath
2.48	5.01	+2.53	202	.90	4	17	29.85	31.60	+ 1.75	106	Stroud
2.92	3.83	+ .91	131	.68	4	21	33.04	36.00	+ 2.96	109	Wolstaston
2.44	3.36	+ .92	138	.64	4	15	29.21	29.28	+ .07	100	Coventry
1.79	2.41	+ .62	135	.66	4	16	23.30	22.36	- .94	96	Boston
2.02	2.37	+ .35	117	.90	12	19	24.70	23.66	- 1.04	96	Hodsock Priory
2.28	2.85	+ .57	125	.52	13	22	26.18	28.38	+ 2.20	108	Derby
4.19	4.59	+ .40	110	.61	7	22	42.43	45.56	+ 3.13	107	Bolton
2.19	2.76	+ .57	126	.60	7	18	26.96	29.44	+ 2.48	109	Ribston Hall
6.41	8.99	+2.58	140	1.24	19	24	60.96	63.30	+ 2.34	104	Arneliffe Vic.
2.36	2.55	+ .19	108	.48	13	23	27.02	24.82	- 2.20	92	Hull
2.64	3.06	+ .42	116	.57	13	24	27.99	27.33	- .66	98	Newcastle
14.70	19.13	+4.43	130	2.85	13	20	132.68	128.81	- 3.87	97	Seathwaite
4.43	7.54	+3.11	170	1.33	4	24	42.81	42.32	- .49	99	Cardiff
5.22	4.26	- .96	82	.65	7	22	47.88	44.17	- 3.71	92	Harverfordwest
4.49	4.59	+ .10	102	.56	7†	21	45.41	47.05	+ 1.64	104	Gogerddan
2.95	2.14	- .81	73	.43	9	18	30.98	26.31	- 4.67	85	Llandudno
4.68	5.53	+ .85	118	1.22	19	14	43.43	49.29	+ 5.86	114	Cargen
3.18	...	...	...	...	...	...	33.04	...	...	...	Riddell House
...	3.77	...	...	1.18	13	17	...	30.19	...	...	Edinburgh
5.24	5.49	+ .25	105	.68	7	23	48.87	57.67	+ 8.80	118	Girvan
3.53	5.58	+2.05	158	.78	20	20	35.80	42.23	+ 6.43	118	Glasgow
6.33	7.51	+1.18	119	1.03	7	22	57.90	64.37	+ 6.47	111	Tighnabruaich
6.48	7.02	+ .54	108	.93	4	20	57.53	55.06	- 2.47	96	Quinish
2.73	3.55	+ .82	130	.95	13	26	28.95	31.40	+ 2.45	108	Dundee
3.15	2.56	- .59	81	...	...	...	36.07	31.53	- 4.54	87	Braemar
3.39	3.77	+ .38	111	1.07	13	18	33.01	32.87	- .14	100	Aberdeen
2.53	1.65	- .88	65	.46	13	8	29.37	30.54	+ 1.17	104	Cawdor
6.67	8.66	+1.99	130	1.25	9	19	56.00	61.29	+ 5.29	109	Invergarry
9.04	9.30	+ .26	103	1.38	4	22	86.50	91.11	+ 4.61	105	Bendamp
3.39	2.81	- .58	83	.78	13	14	31.60	32.17	+ .57	102	Dunrobin Castle
...	3.03	...	...	.60	13	26	...	31.20	...	...	Castletown
6.64	8.31	+1.67	125	.91	3	28	58.11	46.98	- 11.13	81	Killarney
4.31	5.38	+1.07	125	.71	19	25	39.30	39.89	+ .59	102	Waterford
3.37	4.42	+1.05	131	.50	19	28	33.47	37.47	+ 4.00	112	Hurdlestown
3.48	4.07	+ .59	117	.68	19	26	35.19	38.03	+ 2.84	108	Abbey Leix
2.39	2.15	- .24	90	.49	19	22	27.75	26.99	- .76	97	Dublin
3.63	4.22	+ .59	116	1.01	19	25	37.04	37.24	+ .20	101	Ballinasloe
8.99	11.01	+2.02	122	.90	17	24	80.23	74.51	- 5.72	93	Kylemore House
5.81	7.94	+2.13	137	1.30	17	28	50.50	53.81	+ 3.31	107	Ennisceoe
3.64	3.71	+ .07	102	.65	7	23	38.61	39.93	+ 1.32	103	Seaforde
4.31	4.30	- .01	100	.63	10	23	41.20	47.16	+ 5.96	114	Londonderry
3.77	...	...	...	...	...	...	37.85	...	...	...	Omagh

† and 10, 13.

SUPPLEMENTARY RAINFALL, DECEMBER, 1907.

Div.	STATION.	Rain inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	4.49	XI.	Rhayader, Tyrmynydd	6.55
	Ramsgate	1.60		Lake Vyrnwy	7.89
	Hailsham	8.44		Llangyhanfal, Plas Draw	2.19
	Crowborough, Uckfield Lodge	4.42		Criccieth, Talarvor	3.33
	Totland Bay, Aston House	3.02		Llanberis, Pen-y-pass	...
	Emsworth, Redlands	3.87		Lligwy	3.14
	Alton, Ashdell	4.65		Douglas, Woodville	5.35
	Newbury, Welford Park	5.93	XII.	Stoneykirk, Ardwell House	4.28
III.	Harrow Weald, Hill House	3.84		Dalry, The Old Garroch	7.66
	Oxford, Magdalen College	3.74		Langholm, Drove Road	7.03
	Bloxham Grove	3.74		Moniaive, Maxwellton House	6.19
	Pitaford, Sedgebrook	3.60	XIII.	N. Esk Reservoir [Penicuik]	3.50
	Huntingdon, Brampton	3.28	XIV.	Maybole, Knockdon Farm	4.48
	Wisbech, Bank House	2.73	XV.	Campbeltown, Witchburn	5.57
IV.	Southend Water Works	2.44		Inveraray, Newtown	3.72
	Colchester, Lexden	2.48		Ballachulish House	11.29
	Newport, The Vicarage	3.00		Islay, Eallabus	6.08
	Rendlesham	2.64	XVI.	Dollar Academy	6.58
	Swaffham	2.53		Loch Leven Sluice	4.64
	Blakeney	2.84		Balquhiddy, Stronvar	9.06
V.	Bishops Cannings	4.16		Perth, Pitcullen House	4.29
	Ashburton, Druid House	7.94		Coupar Angus Station	3.72
	Okehampton, Oaklands	7.70		Blair Atholl	3.26
	Hartland Abbey	5.37		Montrose, Sunnyside Asylum	3.47
	Lynmouth, Rock House	7.51	XVII.	Alford, Lynturk Manse	3.63
	Probus, Lamellyn	4.90		Keith Station	1.98
	Wellington, The Avenue	...	XVIII.	N. Uist, Lochmaddy	...
	North Cadbury Rectory	4.71		Alvey Manse	1.84
VI.	Clifton, Pembroke Road	6.28		Loch Ness, Drumnadrochit	2.93
	Ross, The Graig	3.71		Glencarron Lodge	8.52
	Shifnal, Hatton Grange	2.42		Fearn, Lower Pitkerrie	2.34
	Cheadle, The Heath House	...	XIX.	Inverashin	3.58
	Blockley, Upton Wold	4.07		Altnaharra	3.16
	Worcester, Boughton Park	3.81		Bettyhill	2.40
VII.	Market Overton	3.22	XX.	Dunmanway, The Rectory	11.80
	Market Rasen	2.16		Cork	7.02
	Bawtry, Hesley Hall	2.30		Darrynane Abbey	9.03
VIII.	Neston, Hinderton Lodge	1.76		Glenam [Clonmel]	7.42
	Southport, Hesketh Park	3.43		Ballingarry, Gurteen	3.65
	Chatburn, Middlewood	5.88		Miltoyn Malbay	5.07
	Cartmel, Flookburgh	5.99	XXI.	Gorey, Courtown House	2.73
IX.	Langsett Moor, Up. Midhope	4.93		Moynalty, Westland	3.92
	Scarborough, Scalby	3.85		Athlone, Twyford	3.39
	Ingleby Greenhow	4.10		Mullingar, Belvedere	3.28
	Mickleton	4.57	XXII.	Woodlawn	4.81
X.	Bardon Mill, Beltingham	3.91		Westport, Murrisk Abbey	...
	Ewesley, Fallowlees	3.86		Collooney, Markree Obay	4.59
	Ilderton, Lilburn Cottage	3.24		Mohill	3.95
	Keswick, York Bank	3.68	XXIII.	Enniskillen, Portora	...
XI.	Llanfarcha Grange	3.37		Warrenpoint, Summer Hill	2.87
	Treherbert, Tyn-y-waun	12.68		Banbridge, Milltown	2.65
	Carmarthen, The Friary	5.36		Belfast, Springfield	4.28
	Castle Malgwyn [Llechryd]	4.43		Bushmills, Dundarave	3.91
	Plynlimon	10.90		Stewartstown, The Square	3.47
	Crickhowell, Ffordlas	6.00		Killybegs	7.59
	New Radnor, Ednol	6.05		Horn Head	5.22

METEOROLOGICAL NOTES ON DECEMBER, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—The most prominent feature was the absence of low temp.; the mean temp. was $42^{\circ}0$, or $2^{\circ}8$ above the average, and the mean shade min. $37^{\circ}6$, or $3^{\circ}2$ above the average. Heavy E fell during the second week, but the latter half of the month was generally dry although extremely sunless. Total duration of sunshine $23\cdot4^*$ hours, of E $57\cdot1$ hours.

CROWBOROUGH.—E $\cdot99$ in. above the average. Comparatively mild till 23rd, with frequent gales during the first fortnight. The last 8 days were cold, with keen E. and N.E. winds. Mean temp. $40^{\circ}1$, or $1^{\circ}1$ above the average.

WEST DEAN.—Mild and wet, with E double, and mean temp. nearly 3° above the average. From 24th to the end was dark and gloomy.

TORQUAY.—Mean temp. $45^{\circ}6$, or $2^{\circ}0$ above the average. Duration of sunshine $48\cdot4^*$ hours, or $5\cdot2$ below the average.

CLIFTON.—Except 1876 the wettest December in 52 years. Heavy E fell every day till 13th. The last week was dry and cold, with E. winds.

BOLTON.—Remarkably dull, only $3\cdot2^*$ hours of sunshine being registered, or $9\cdot6$ below the average; 26 sunless days. Temp. above the average for the first three weeks, after which the wind changed to E. and the temp. fell 10° . Mean temp. $39^{\circ}7$, or $0^{\circ}7$ above the average.

SOUTHPORT.—Mild and wet till 23rd; afterwards colder and very dry with E. wind. Mean temp. $40^{\circ}2$, or $0^{\circ}6$ above the average. Duration of sunshine 35^* hours, or 3 above the average. E $\cdot45$ in. above the average; duration $48\cdot3$ hours.

HULL.—Almost sunless, the total duration being only 3^* hours. Frequent E. and mist. Dense fog on 18th, 23rd and 24th.

HAVERFORDWEST.—A stormy month, mild till 22nd, after which frost was much needed to check vegetation. Duration of sunshine $36\cdot6^*$ hours.

DOUGLAS.—An almost unbroken period of heavy E. or gales to 23rd, the land being full of water. Afterwards violent E. gales causing great dislocation of the cross-channel mail services; these still showed no signs of abating at the end when the weather was extremely cold.

COUPAR ANGUS.—The most persistently wet month of the year. Mean temp. $35^{\circ}8$, being normal.

ABERDEEN.—Dull and wet with little frost, and no S. Wind, chiefly W., S.W., and S.

DRUMNADECHIT.—E $1\cdot18$ in. below, and rain days 1 above, the average of 21 years. E fell on each of the first 23 days, but the last 8 were dry and frosty. There was no S.

CATTLETOWN.—Fresh and open throughout. There was practically no S.

CORK.—E $2\cdot57$ in. above the average. Prevailing winds S.W. and E.; gales from N.W. on 13th, and from S.E. on 25th and 26th. Dense fog on 23rd. S on 2nd.

DARRYNAKE.—E 63 per cent. above the average of 28 years, and the heaviest for December in that period. On the whole it was mild, but the last 5 days were very cold.

MILTOWN MALBAY.—Miserably cold and wet ending with a blizzard on 27th.

DUBLIN.—Cloudy and dull, with frequent but not excessive precipitation. Very mild from 18th to 22nd, followed by strong S.E. and E. winds, and bitterly cold in last week. Mean temp. $43^{\circ}0$, or 1° above the average.

KYLEMORE.—Remarkable for much S. and sleet, with a considerable amount of black frost towards the end, with strong E. winds.

MARKREE OBSERVATORY.—E fell continually till 26th, with frequent H. sleet and gales at times. S on 30th and 31st. Temp. about the average, but bright sunshine deficient.

* Campbell-Stokes.

Climatological Table for the British Empire, July, 1907.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain		Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.		
	Temp.	Date.	Temp.	Date.									Cloud.	
London, Camden Square	78°·1	19	42°·3	11	70°·0	51°·3	59°·2	6·100	77	122°·9	39°·9	1·96	15	7·0
Malta	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Lagos	86·0	1	68·5	30	81·8	73·3	73·1	86	158·0	63·0	20·08	25	8·7	...
Cape Town	79·4	9	37·0	3	65·8	45·4	46·5	69	...	...	1·38	3	3·8	...
Durban, Natal	83·1	17	46·1	8	74·0	52·3	...	...	133·1	...	1·6	5	1·8	...
Johannesburg	65·1	19	29·6	4	59·3	40·3	37·3	69	132·8	23·1	·00	0	0·8	...
Mauritius	77·0	5	54·8	23	73·5	60·9	58·2	73	135·9	46·0	·33	9	5·9	...
Calcutta	92·1	19	74·6	8	89·5	79·4	78·3	85	154·9	72·7	8·16	16	8·6	...
Bombay	89·1	10	73·5	24	84·8	78·0	76·9	86	134·1	71·8	59·26	26	8·5	...
Madras	100·8	14	75·0	9	96·0	78·7	73·6	69	143·5	72·8	2·80	11	5·9	...
Kodaikanal	67·2	11	49·7	30	62·7	52·7	51·9	85	136·8	43·1	3·90	26	7·6	...
Colombo, Ceylon	87·3	9	72·2	13	85·5	77·0	74·0	81	146·3	72·0	8·71	14	7·4	...
Hongkong	90·2	16	74·7	17	87·1	79·1	75·4	80	141·6	...	7·39	15	7·2	...
Melbourne	65·4	26	31·1	19	55·2	41·3	40·8	78	116·2	23·6	2·17	11	6·0	...
Adelaide	69·3	31	36·1	18	58·8	44·8	44·8	79	120·9	31·8	2·81	20	6·5	...
Coolgardie	75·5	17	34·4	10	62·1	42·9	41·9	66	139·9	27·5	1·07	11	5·4	...
Sydney	66·3	22	37·9	14	59·7	44·6	41·2	77	98·9	28·0	·37	14	3·4	...
Wellington	59·0	31	34·0	11	51·6	42·2	38·2	76	94·0	26·0	3·75	13	5·8	...
Auckland	61·0	2	39·0	10	55·9	46·4	46·0	83	113·0	35·0	6·33	19	6·4	...
Jamaica, Negril Point.	91·0	12	69·2	5	88·0	71·9	71·8	72	...	...	3·90	15	6·1	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	85·0	10.26	70·0	20	83·0	73·5	71·2	80	141·2	...	10·73	26	5·5	...
Toronto	90·0	16	48·1	4	80·7	57·8	...	...	106·5	44·7	2·03	...	4·3	...
Fredericton	87·8	17	46·0	29	73·9	55·0	...	80	...	...	3·50	12	7·1	...
St. John's, N.B.	76·5	4	49·5	2	66·9	54·8	...	...	...	...	4·33	18	...	...
Victoria, B.C.	87·1	30	46·7	5	...	...	...	...	...	...	·39	2	3·0	...
Dawson	88·5	31	38·0	5	72·3	45·6	...	...	...	...	1·93	11	5·7	...

LAGOS.—3·63 in. of E fell on the 18th.

JOHANNESBURG.—Bright sunshine 308·12 hours.

MAURITIUS.—Mean temp. of air 0°·5, of dew point 1°·2, relative humidity 2·3 per cent., and E 1·91 in., below averages. Mean hourly velocity of wind 10·9 miles, or 1·1 mile below average.

MADRAS.—E 28 per cent. below. Bright sunshine 132·0 hours. TSS on 4 days.

KODAIKANAL.—Bright sunshine 101 hours.

COLOMBO.—Mean temp. of air 80°·5 or 0°·2 below, of dew point 0°·7 above, and E 4·09 in. above, averages. Mean hourly velocity of wind 8·1 miles. TS on 12th.

HONGKONG.—Mean temp. of air 82°·5. Bright sunshine 210·5 hours. Mean hourly velocity of wind 10·3 miles. E 5·94 in. below average.

ADELAIDE.—Mean temp. of air 0°·3 above, and E ·24 in. above, averages.

SYDNEY.—Mean temp. of air 0°·1 below, and E 4·10 in. below, averages.

WELLINGTON.—Mean temp. of air 0°·7 below, and E 2·25 in. below, averages.

AUCKLAND.—E 1·50 in. above the average. A wet and stormy month. Heavy gales doing much damage on 2nd, 3rd, 20th and 21st.

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